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THE "FERRANTI" MACHINE.

Although so much interest has recently been excited in the public mind by the various reports which have been circulated as to the revolution to be effected in electric lighting by the new dynamo-electric machine devised by Mr. Ferranti, the effect on the shares of the other electric light companies has been comparatively nothing worth speaking of. Whether this state of things will continue remains to be seen; but it appears evident that the public is beginning to understand what may be expected from the very best machines that we can ever hope to produce. We may mention here that the system of electric lighting of which we are now speaking, and which is being brought forward under the auspices of the "Hammond" Electric Light Company, is known under the name of "Ferranti" only, Sir William Thomson's connection with the former gentleman being in the alternating current machine of which they are joint inventors. An interesting correspondence, touching the efficiency of the new machine, has recently taken place in the columns of the *Times*, and a Mr. Pertwee—evidently an enthusiastic advocate of the Ferranti system—makes use of what knowledge he possesses regarding the merits of the recent invention to place the Brush machines in a bad light. The secretary of the Anglo-American Brush Electric Light Corporation has replied to Mr. Pertwee's criticisms, very much to the point; however, we can only express a wish that the public will look at such correspondence with indifference, until they can be actually supplied with genuine figures on which to base their judgment.

It is easy for those conversant with the details of electric lighting to see where comparisons fail, but the general public cannot yet be expected to understand that machines constructed for arc lights will not answer for incandescence lamps. We stated in our columns a short time since that it was difficult to credit the stated low efficiency of the Brush machine for incandescent lighting, more especially if constructed for the latter purpose, and we now find that the results given were obtained from a machine manufactured for arc lighting. Eleven incandescent lamps, of 20 candle-power each per horse-power, from a Ferranti dynamo is not such an exceedingly startling performance as many would imagine, unless we understand by this that the horse-power is that of the engine, and not electrical. We do not know where Mr. Pertwee gets his information from concerning the large Ferranti machine for 25,000 lamps, and upon which he bases some comparative estimates, but we presume that all the various types of these machines are calculated from the experimental one. There is, however, really in existence a dynamo-electric machine, devised by another inventor, which we believe was constructed either for 5,000 or 8,000 lamps. This we hear is, experimentally, highly successful, and as many as 2,000 incandescence lights have at present been connected up with the machine. We are not at liberty to publish further information we have regarding this dynamo, the largest by far yet actually constructed, but as its results will be eagerly looked for we shall endeavour to keep our readers informed as to its performances. To the best of our knowledge, only a small experimental Ferranti machine has yet been tested, and on the strength of this the Hammond Electric Light Company has issued a pamphlet giving estimates for complete installations of the Ferranti system, from 25 to 25,000 incandescence lamps, and from 1 to 65 arc lamps, each system of lighting being from one machine.

We recommend this circular to the notice of all interested in electric lighting, and it may not be out of place to give some particulars here as to the estimated prices of these new machines. One F^2 Ferranti dynamo, for 65 lamps of 4,500 (nominal) candle-power each, £650, and an E^2 machine, for 32 similar lamps, £350. For 65 arc lamps, of 2,000 (nominal) candle-power each, one E^1 machine costs £350, and a machine for 26 similar lamps, £200. Concerning these latter it is stated that three-quarter indicated horse-power is required for each light. It would be premature to express an opinion on this matter at present, but one thing is certain, that if machines to produce the above results can be sold at the prices quoted, then the venture of the Hammond Electric Light Company will be well repaid; and the public also will not be slow to take advantage of the greater inducements offered to further the progress of electric lighting.

NEW DYNAMO-ELECTRIC MACHINES

There is no doubt but that the commutator of a continuous current dynamo-electric machine gives generally more trouble, and requires more attention, than any of the other parts of such apparatus. The reasons why the commutator requires special care are too well known to electricians to render it necessary for us to dwell upon them; and to do away with this portion of the machine altogether has long been the aim of many inventors.

We do not know of any successful result in this direction as yet, and when an invention professing to accomplish this object is brought forward it deserves more than passing notice.

There has just been issued the specification of H. E. Newton (communicated by Alphonse Isidore Gravier, of Paris). M. Gravier's previous ideas are well known to electric light engineers, and the object of the present invention is the production of continuous or of alternating currents from a dynamo-electric machine, either in intensity, quantity, or in series, without the use of rubbers, collectors, brushes, or commutators.

The inventor says that by studying the action of dynamo or magneto-electric machines, one general fact which dominates them all is apparent, viz., the necessity for the commutation of the current produced.

Thus if a permanent or electro-magnet be caused to turn in front of a system of bobbins however arranged, currents are induced in these bobbins which change in direction at each half revolution of the inducing magnet.

This is all very well when such alternating currents can be utilised; but should continuous currents be required, recourse must be had to various contrivances, such as commutators, rubbers, brushes, &c.

Besides this, the currents thus obtained and re-arranged are not continuous in the strict interpretation of the word. They are in the same direction, it is true, but they really consist of a series of short currents starting from zero, rising

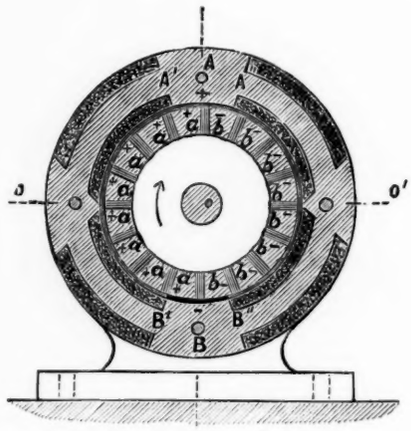


Fig. 1.

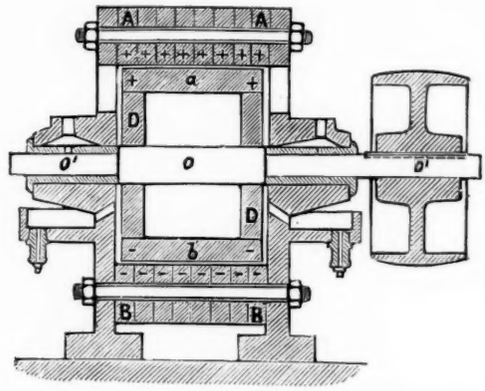


Fig. 2

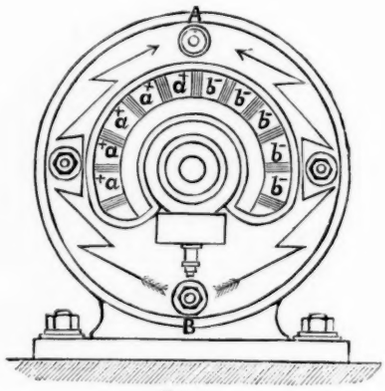


Fig. 3.

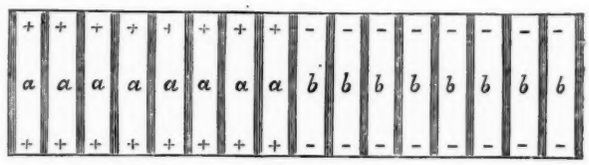


Fig. 4.

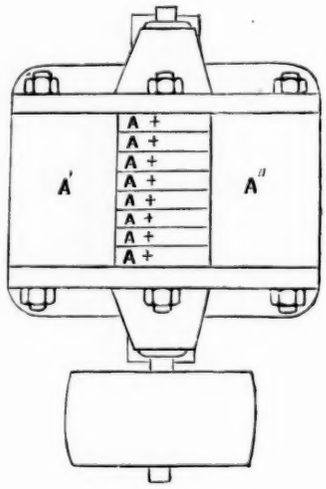


Fig. 5.

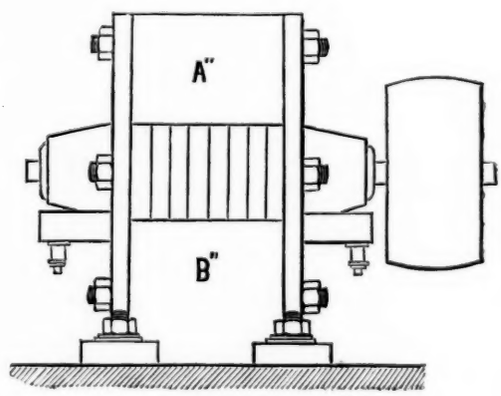


Fig. 6.

Fig. 8.

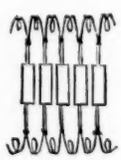


Fig. 9.

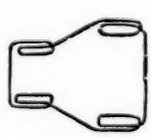


Fig. 10.

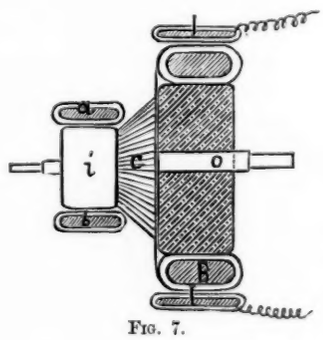


Fig. 7.

to a maximum of intensity and descending again to zero, these currents being adjusted to each other by means of the commutators, rubbers, or brushes.

M. Gravier then illustrates diagrammatically the rise and fall of an ordinary alternating current, and also of a continuous current during one entire revolution of the inducing magnet.

He then, by means of other diagrams and experiments, shows that the successive inversions of the induced currents are due to the successive passages of inductors of opposite polarities. His conclusion is, that as the successive passages of opposite inductive polarities furnish induced alternating currents, it is only logical to suppose that successive passages of inductive polarities of the same sign, would furnish induced currents in the same direction and the rearrangement or commutation of the induced current would thereby be avoided; it would, however, be necessary to effect the commutation of the magnetic poles of the inducing magnets.

Therefore the chief object of M. Gravier's invention is to substitute for the commutation of the induced currents the preliminary commutation of the magnetic poles of the inducing magnets.

The inventor thus describes his apparatus :—

The magnetic commutation inductor will be composed of soft iron, copper or soft iron combined with copper, or any other metal which may offer advantages in respect to price or inductive capabilities.

As to its form it may take all those furnished by the solids of revolution or any other figure that can be inscribed in a solid of revolution; in a word, it may take any of the forms that an electro-magnet simple or compound is capable of taking, and it may be in a single piece or in a number of pieces.

It is to be placed in a magnetic field of one or of several permanent, or electro-magnets of which it sustains the magnetic influence. It is to be surrounded concentrically with circuits upon which it should exercise its inductive influence.

In certain cases it may be placed in the circuit of an exterior source.

Its movement determines the magnetic or electro-magnetic commutation of its elements.

Its motion will be by preference rotary, but in certain cases it may have an alternating rectilinear motion, or an alternating circular motion imparted to it.

It is influenced either by the magnetic field in which it is placed, by the current from an exterior source, or by both combined.

It will react by its motion upon the induction circuits in which it is placed. The induction armatures and the fixed induced circuits may be dependent upon each other, or may be independent of each other.

In the case of simple magnetic commutation no mechanical connection will exist between the movable induction armature and the fixed induced circuit. The only connection in this case is simply magnetic.

Figs. 1, 2, 3, 4, 5, and 6, of the accompanying drawings, represent various views of a continuous current machine constructed according to this invention, without commutator or collectors, but with magnetic commutation inductor.

Fig. 1 is a transverse section of the machine, showing the arrangements adopted for the magnetic commutation inductor or rotary armature and the fixed magnet.

Fig. 2 is a longitudinal section, and fig. 3 a side elevation of the same.

Fig. 4 is a development of the rotary armature of the machine, showing the arrangement of the magnetic polarities when under the influence of the poles of the fixed electro-magnets.

Fig. 5 is a plan of the machine.

Fig. 6 is an end elevation of the same.

The induction cylinder or revolving armature is shown as composed of sixteen bars of soft iron, *a a a*, *b b b*, separated slightly from one another by pieces of paper, or other suitable material. These bars are mounted upon and secured at their extremities to two discs of soft iron, D D, by means of screws, and the whole is mounted upon an axle, *o*, turning in suitable bearings.

The stationary field magnet, A A^1 A^{11}, B B^1 B^{11}, is composed of eight cast-iron rings, one of these rings being hardened so as to retain a certain amount of residual magnetism for the initial effect.

Fig. 1 shows the configuration and the mode of coiling of the field magnets.

The eight rings are separated by insulating material, and are clamped together by means of bolts, two exterior frames of cast iron provided with plummer blocks completing the iron part of the fixed field magnet, and being solidly clamped to the eight rings by the same bolts.

The winding of the wire is in actual practice divided in such a manner as to form forty separate circuits, the extremities of each of which terminate in a grouping table to allow of the circuits being grouped together in any way that may be found desirable either in quantity, tension, or in series.

On starting the rotary armature it will be polarised by the residual magnetism of the exterior magnet and an electrical current will be induced in the coils of the exterior magnet. This current will strengthen the fixed magnet which in its turn will strengthen the rotating armature and induce a current in the coils thereof.

A reciprocal action being thus set up the currents of electricity will flow from the terminals of the coils of the external magnet, which may be used as above stated without employing a commutator and collectors.

As a modification of the above, two rotary armatures of different dimensions may be mounted on the same axle, the larger one being coiled so as to produce two consequent poles, and the coils connected by metal plates with the coils of the adjacent smaller armature. Both armatures will be provided with field magnets, the larger field magnet being coiled so as to produce two or more currents, one or more of which should circulate in the coils of the smaller field magnet.

This arrangement is illustrated at figs. 7, 8, 9 and 10, of the drawings, fig. 7 being a vertical section through the axis of the machine, in which *a b* is an annular electro-magnet with two consequent poles within which is mounted upon an axle, *o*, the inducing ring, *i*. A B is another annular electro-magnet also with two consequent poles, and mounted upon a wooden filling piece keyed fast to the axle, *o*. The core of this electro-magnet, like all the others, consists either of cast iron or of thin plates of sheet iron, placed together and formed with notches, as seen in fig. 8. It is of sufficient size to admit of there being placed upon it about thirty kilogrammes of wire having a resistance equal to ten ohms, and is five times larger than the core of the ring, *i*.

c is a radial conductor which may be cylindrical or conical. To each of the plates of the conductor are connected on one side the entering and exit ends of two consecutive helices of the inducing ring, *i*, and at the opposite side the entering and exit ends of two consecutive helices of the inductor ring, A B, as indicated in the diagram, fig. 9, which also shows the course of the currents from the primary or induced to the secondary or inductor magnets.

Fig. 10 is a diagram showing another arrangement in which each helix of the ring, *i*, is connected to the corresponding helix of the ring, A B, in such a way that each pair of helices of the ring, *i*, forms with the corresponding pair of helices on the ring, A B, a closed circuit. The helices are in this case "in quantity."

Under these conditions in either of the two systems the induced currents of the ring, *i*, pass to the inductor ring, A B, just at the points, where in the ordinary way the brushes or rubbers would be placed.

In fig. 7, I I is a fixed exterior ring covered with, say, 7,500 kilogrammes of wire, having a resistance of 0·35 ohms.

On rotating the axes, *o*, carrying the two armatures, a continuous current will be induced in the wire of the ring, I I, which current may be utilised in any desired mannner, a portion however being furnished to the primary inductor, *a b*.

We have thought the invention of M. Gravier of sufficient interest to many of the readers of the ELECTRICAL REVIEW to give it a prominent position in our columns, but we shall reserve any remarks on this dynamo-electric machine for a future occasion.

THE Iberian Electric Light Company is, we understand, in course of voluntary liquidation.

VYLE'S DOUBLE CURRENT KEY.

Speed and ease of working on the Morse system is greatly influenced by the form of key employed. The design of even the simplest form of single current key is by no means a matter of unimportance, though judging from some of the wonderful and fearful patterns of this simple piece of apparatus which we find illustrated in many of our electrical text books, it might be imagined that the matter is not of the slightest moment. Practical telegraphists, however, who are the best judges of such matters, know very well the advantages and disadvantages of particular patterns. The double current system, which in this country is largely employed, especially on long circuits, is worked, as is well known, by a key, which, by its action causes reversals in the line current; this arrangement necessitates the use of four contact points, and as it is necessary that two of these be brought into action when the key is depressed and the other two when it is raised, and moreover that the makes and breaks of contact be made with certainty, the *play* of the key has to be made comparatively large. This length of *play* is an objectionable feature in the double current key, as it hinders quick working, and moreover renders the latter more fatiguing than is the case with the single current key, where the play can be reduced almost to nothing. The object of Mr. Vyle's double current key is to reduce the amount of play down to that required for a single current key, without sacrificing the certainty of the contacts being properly made and broken. The general view of the key is shown by fig. 1.

Fig. 1.

It will be seen that eight terminals are provided, three of these are, however, simply for the purpose of enabling the key to be used for single current working, so that a single current and a double current circuit can both be worked at the same time; this feature is not, however, claimed as a special improvement.

The smallness of the play in the contacts is obtained by the following arrangement (shown by fig. 2*). The

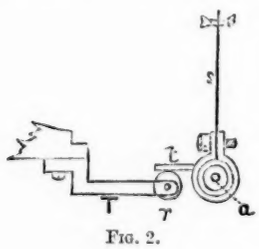


Fig. 2.

end, T, of the main lever of the key is provided with a small roller, *r*, this roller presses against the short lever, *t*, fixed to the axle, *a*, on which are fixed two insulated springs, one of which, *s*, is seen in fig. 2. These insulated springs are connected to "line" and "earth" respectively, and play between insulated contacts as in the ordinary double current key. Now the lever, *t*, being short, a very small movement of the lever, T, will move the ends of the contact springs, *s*, *s*, through a considerable distance, so that the contact screws need not be set very close together, and as the motion is caused through the medium of the roller, *r*, the motion is very easy.

A special feature in the key is the vertical arrangement of the contact springs and their contacts, which renders the adjustment of the latter very easy, since they are easily seen and got at.

* This figure is drawn from the reverse side of the key to that shown by fig. 1.

REVIEWS.

Guide des Epreuves Electriques. Par Valdemar Hoskiær. Traduit sur la seconde édition anglaise, par A. L. Ternant. Paris: G. Masson.

The translation of Capt. Hoskiær's well-known work could hardly have been undertaken by anyone better qualified than M. Ternant. The book being a mere translation does not afford scope for criticism, and we need not say more than that French scientific literature will be decidedly benefited by the addition of the work in question.

La Navigation Electrique. Par Georges Dary. Paris: Librairie Polytechnique de J. Baudry.

We have already alluded to this work in our last issue. Although it consists of but 65 pages the information given is very complete, and it is fully illustrated. The progress made in electrical navigation had been so small up to the time when M. Trouvé took the subject in hand, that practically the description of the system of this gentleman forms the bulk of the book. The recent successful experiments on the Thames have increased the interest in electrical navigation, and therefore the publication of M. Dary's work is very opportune.

Détermination des Eléments de Construction des Electro-aimants. Par M. Th. Du Moncel. Deuxième édition. Paris: Gauthier-Villars.

Much of the matter contained in this small work has already been published—indeed, in the early pages of the Electrical Review several articles on the subject will be found. Not only has M. Du Moncel very fully determined the theoretical laws which govern the construction of electro-magnets, but he has also verified the correctness of the results by experimental examples; this is decidedly a very important feature, as, although those *savants* who are able to follow the mathematical deductions would probably be satisfied with the conclusions arrived at, there are many who would hesitate to accept the statements unless they were verified by practical results. Interesting as the book is to lovers of theory—and there are many such—its value to

practical electricians is perhaps not great; continual experiment has effected what theory might have assisted if it had been developed earlier. It is very often the case that practice goes in advance of theory, and the latter, instead of effecting, merely explains results. This is very much the case with electro-magnets, for the best forms of the latter have been so nearly determined by experience that theory can now do but little to assist. Of course there may be further developments in the use of electro-magnets, especially as regards fast speed telegraphing, which have yet to be made, and which may be helped forward by a complete theoretical knowledge of the laws which govern the working of electro-magnets, and therefore the information which the Comte Du Moncel has carefully and ably worked out may yet prove valuable.

THE BREGUET REGULATOR.

The regulator of which we are about to give the description was devised by the *Maison Breguet*, with the object of making a simple and strong lamp little subject to derangement or accident, requiring no supervision, of easy installation, and moderate price. The principle of its construction is such that it can be established at will in derivation or in series upon a continuous current machine of sufficient power.

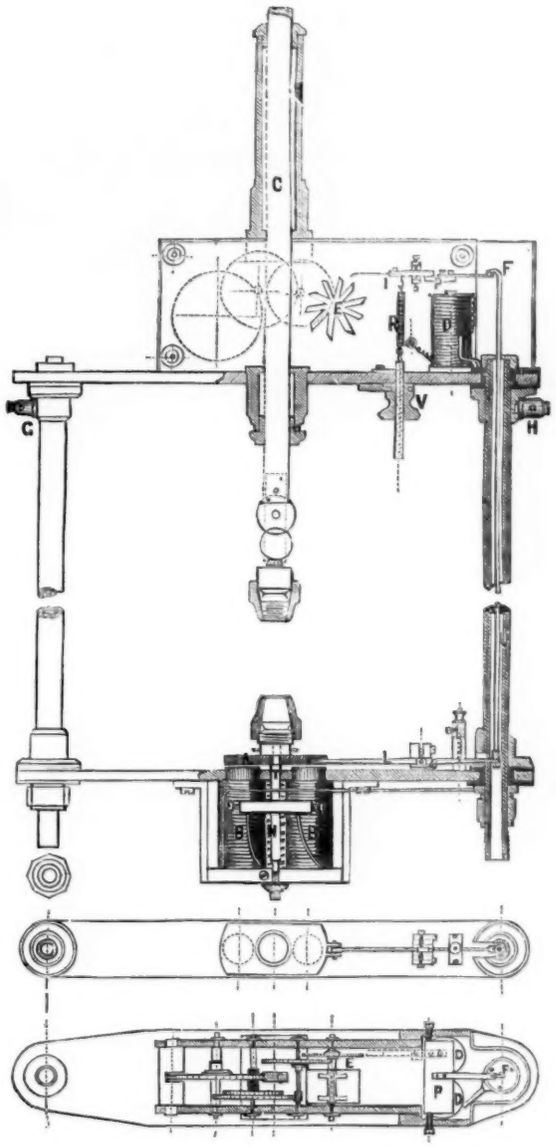
It may be defined as a weight and clockwork regulator, controlled by an electro-magnet in derivation and in which the initial motion is produced by the action of a second electro-magnet in circuit. The drawing will explain its arrangements and operation. The clockwork movement and escapement are disposed in a box placed at the upper part and traversed by a bar, C, which serves as the motive weight and carries the positive carbon. This bar commands a series of moving parts, of which the last is a star-shaped wheel, E, similar to the Serrin regulator.

This wheel is engaged by a flat spring fixed upon the armature, P, of the electro-magnet, D, joined up as a shunt, so that the current which traverses this coil is too feeble to counterbalance the opposing spring, R, the tension of which is regulated by the aid of the screw, V.

The negative carbon-holder is fixed upon a vertical rod, T, bearing an armature, A, placed in front of an electro-magnet of thick wire, B, in the main circuit, and moved constantly upwards by the action of a spiral spring, N, placed between the two branches of the electro-magnet. Let us suppose that, the apparatus being at rest, the carbons are in contact. The moment the current passes, coming from the terminal, G, it is split between the carbons and the electro-magnet, B, on one hand, and the shunt coil, D, on the other. The armature, A, is powerfully attracted, and produces the initial movement, whilst D, which at the beginning is not traversed by a sufficiently powerful current, keeps the wheel, E, locked. (We neglect for a time a part of the mechanism, of which we shall presently examine the function.) In proportion as the carbons are consumed, the arc is lengthened. The portion of the current which traverses D increases; at a given moment it becomes sufficiently powerful to disengage the star-wheel, E, which then allows the descent of the upper carbon, until the derivation, becoming again enfeebled, the spring, R, replaces the lever, I, and produces the locking of the star-wheel, E.

The regulation and the initial motion of the carbons is produced, therefore, individually in each lamp in a manner entirely independent of that of other lights, placed either in series or in derivation. It remains now for us to explain the *rôle* of the lever, L, of the rod, U, and the hook, F. If the carbons were always in contact at the time of lighting, these pieces would be useless, and we could easily dispense with them, but it happens sometimes that the carbons are very widely separated one from the other, when new carbons have just been inserted, for example, or when one of the carbons is broken, &c.

The combination of the lever, L, the rod, U, and the hook, F, is disposed in such a manner that, whilst the star-wheel, E, is always unlocked, and permits the descent of the upper carbon until it meets the lower, so long as the current does not traverse them; the moment they touch the armature, A, is attracted, the lever, L, oscillates around O, raises U, and the hook, F, which liberates the armature, P, and the lever, I. This arrangement could be dispensed with in machines separately excited or excited in derivation, because in these machines the current which would traverse the electro-magnet, D, at the moment of lighting would be sufficient to attract P, and unlock the star-wheel, E; but with machines in which the inductors are placed in the general circuit, the total resistance would be too great to produce the starting of the machine; the electro-magnet, D, would not act, and the regulators would prove defective. Owing to the ingenious combination which we have just described, such a drawback is avoided.



This apparatus is constructed in two forms:—

1. The form M, constructed to supply five lights in series by the aid of a Gramme machine, Type F, burning carbons of 12 millimetres, and using a current of 13 ampères, and 50 volts difference of potential at the terminals of the lamp. It furnishes a light of from 100 to 125 Carcel jets.

2. The form N, constructed to supply three lights in derivation upon a Gramme machine of the workshop type (Type A), burning carbons of seven millimetres, and working with a current from 5·5 to 6 ampères, and 50 volts difference of potential at the terminals of the lamp. The light given is from 40 to 60 Carcel jets.

The Breguet regulator can, therefore, be established either in circuit, like the Brush, Gramme, Lontin, &c., or in derivation, like the Gülcher lamp, according to the applications in

view and the current furnished by the machines we have at disposal. In the first case it is especially suitable for workshops of large size, railway stations, concert rooms, &c.; in the second, it is applicable to small low buildings in which the shadows cast necessitate lights of medium power and in greater numbers.

THE ELECTRICAL LAUNCH.

It will be remembered that we briefly alluded in the last number of The Electrical Review to the trip we were privileged to enjoy in this electrically-propelled vessel. We are now enabled, through the kindness of Mr. Reckenzaun, C.E., the mechanical engineer to the Electrical Power Storage Company, to give our readers very complete detailed sketches of the *Electricity* and her machinery.

In an article to our esteemed contemporary *Nature*, Professor Silvanus Thompson gives an illustration and description of Jacobi's electro-magnetic motor which is sufficiently interesting to reproduce. Professor Thompson says :—

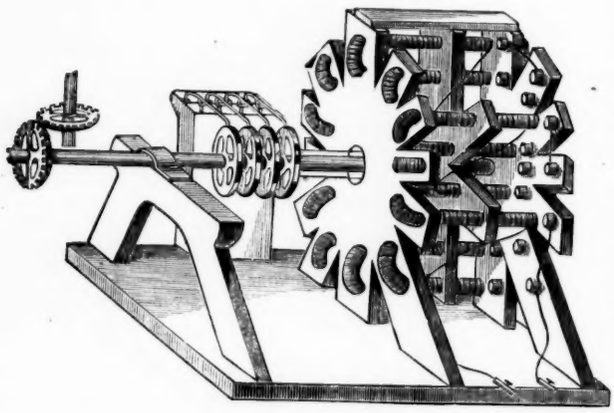


Fig. 1.

"Fig. 1, which we here reproduce from Hessler's "Lehrbuch der Technischen Physik," represents the rude electro-magnetic motor or engine which Jacobi devised for the driving of his boat. Two series of electro-magnets of horse-shoe form were fixed upon substantial wooden frames, and between them, centred upon a shaft which was connected to the paddle-wheels, rotated a third frame, carrying a set of straight electro-magnets. By means of a commutator made of notched copper wheels, which changed the direction of the current at appropriate intervals, the moving electro-magnets were first attracted towards the opposing poles, and then, as they neared them, were caused to be repelled past, so providing a means of keeping up a continuous rotation. This machine was worked at first by a Daniell's battery of 320 couples, containing plates of zinc and copper 36 square inches each, and excited by a charge of sulphuric acid and sulphate of copper. The speed attained with this battery did not reach so much as 1¼ miles per hour. But in the following year, 1839, the improvement was made of substituting 64 Grove's cells, in each of which the platinum plates were 36 square inches in area. The boat, which was about 28 ft. long, 7½ broad, and not quite 3 ft. in depth, was propelled, with a convoy of fourteen persons, along the River Neva, at a speed of 2¼ (English) miles per hour."

Figs. 2, 3, and 4 show respectively a plan of the launch with the cabin removed and the longitudinal and midships sections. These illustrations are so self-explanatory that it only remains for us to refer to several minor details. A, A, are ampèremeters of the Ayrton and Perry construction, B is a commutator for putting in circuit extra secondary battery cells as may be requisite, and C, C, are switches by means of which the current supplied by the accumulators may be cut off from either or both machines. L is a clutch-lever for manipulating an "Addyman's" friction-clutch, by means of which one of the motors may be thrown in or out of gear without the slightest noise. H is a handle for applying the reversing gear, which is shown fully in fig. 5, where P and S represent the commutators of the two Siemens dynamo-electric machines, P M acting as port, and S M as starboard motors respectively. The two pairs of brushes are shown at *a*, *a'*, *b*, *b'*, and either pair can be made to touch the commutators by raising or lowering the spring-lever, R, the brush-holders, *c* and *d*, acting as cams, so that the same pressure should act upon all the brushes in action. By moving the handle, H, to the left, the opposite pairs of brushes of both machines will come in contact simultaneously, and the direction of the armature is instantly reversed. The screw-shaft is represented at O. It will be noticed that the power of the electro-motors is transmitted to the screw-shaft by means of belts and pulleys, since it was not desirable to work the propeller at from 900 to 1,000 revolutions per minute; and the screw, therefore, runs at 350 turns to give its maximum efficiency. The accumulators are placed partly under the seats and floor, and partly under the aft deck. The size of these cells is 7⅛ in. high by 9½ in. by 8½ in., and the 45 constituting the battery weigh about 2,700 lbs. The commutator and switches before alluded to, the clutch-lever, reversing-lever, and steering-wheel, are all under the immediate command of one man. We understand that the launch has been running daily since the trial-trip, and the secondary cells of Messrs. Sellon and Volckmar have acted admirably, giving a constant current of 48 ampères for six consecutive hours. The maximum useful energy of these accumulators is four horse-power. They are charged through cables from a dynamo-electric machine in the works whilst the vessel lies at her moorings. A special propeller is now being constructed to be driven direct from the motor at a high speed, with a view of testing its efficiency.

A sketch of the entire electrical connections is shown in fig. 6. The accumulators are represented at A, leading to the commutator, B, by the employment of which the number of cells in circuit may be varied. C, C, show the switches for applying or cutting off the current to the machines (and to which the ampèremeters are connected), represented in outline, with their terminals placed below. The cells are all joined in series, and the two machines are coupled up parallel. The switches are so made that the ampèremeters may be inserted in the circuit at will, but in practice they are always on for convenience. We may add that the design and construction of the *Electricity* are due almost entirely to Mr. Reckenzaun, to whom we tender our thanks for the great assistance we have received at his hands.

We shall await with great interest further developments of electrical navigation by means of accumulators, and we congratulate the Electrical Power Storage Company, not merely on this application of electricity, but upon the success which will probably attend the energetic way in which they are going to work in the matter of electrical accumulators. The factory of this company is no mere experimental works, for the number of men now busily engaged in all the branches of secondary battery manufacture, exceeds 300, we believe. We hope shortly to place before our readers subjects of great interest connected with this work.

The French Post-office.—The Minister of Posts and Telegraphs in France has published a report showing the results of the work transacted in his department last year, and the progress which has been made since 1877, at the end of which year the posts and telegraphs were detached from the Ministry of France and made into a separate department. There was an increase equivalent to 56 per cent. in the work of the Post-office, but the increase in the Telegraph Department was very much greater, amounting to no less than 138 per cent. The number of telegrams sent in 1877 was only 8,174,000, while last year it was 19,466,000. The number of post-offices open at the end of last year was 6,128, and in this respect France is not nearly so well off as most European countries, there being 30,120 parishes which have no post-office of their own. There are 52,032 letter-boxes, and 5,481 telegraph-offices, the total length of telegraph wires in France being 132,420 miles, in addition to 520 miles of underground telegraphs. The underground telegraphs are being laid with great rapidity, and a sum of two millions sterling has been voted by the Chamber to bring the total length of the underground line to 4,900 miles.

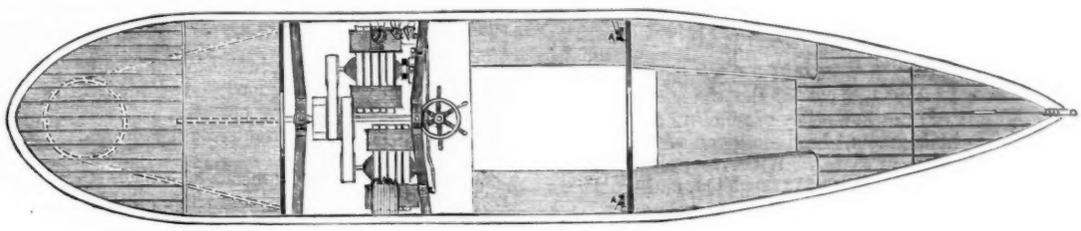


Fig. 2.

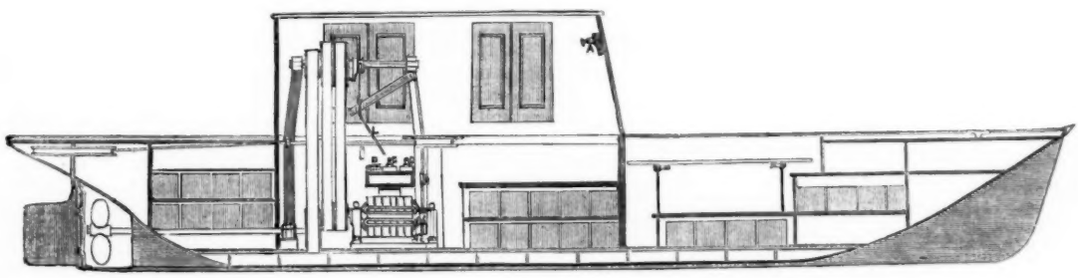


Fig. 3.

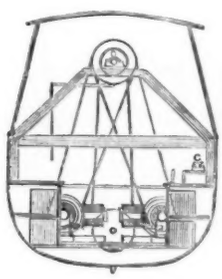


Fig. 4.

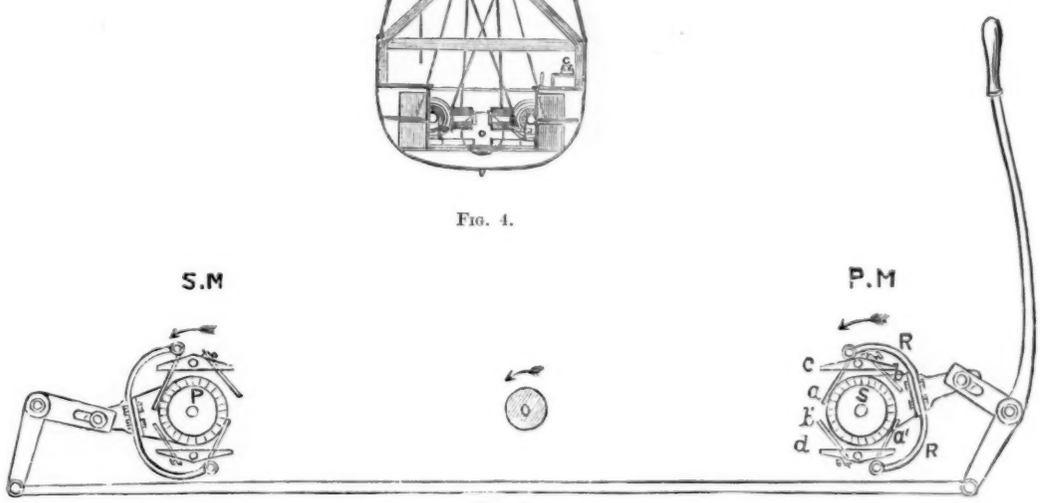


Fig. 5.

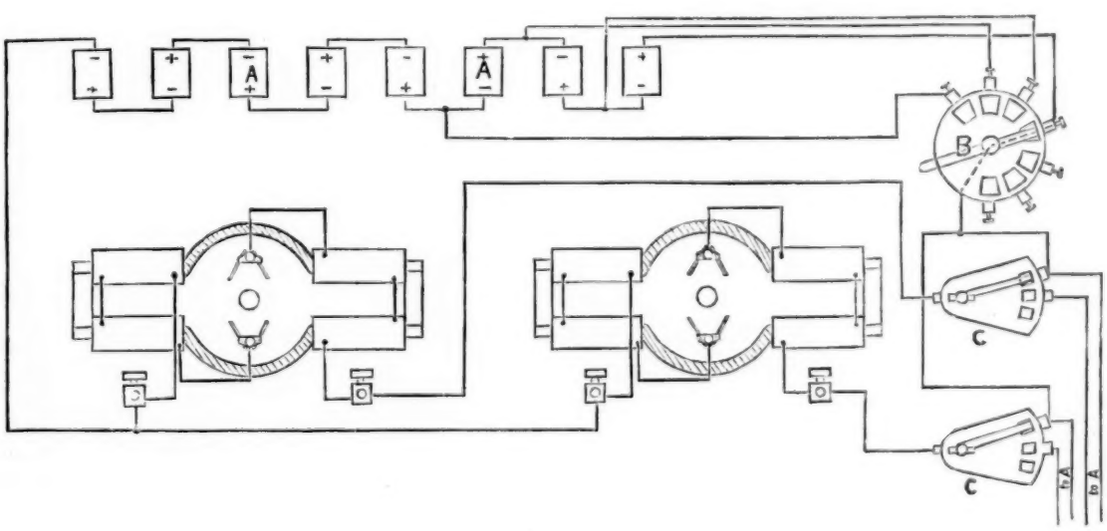


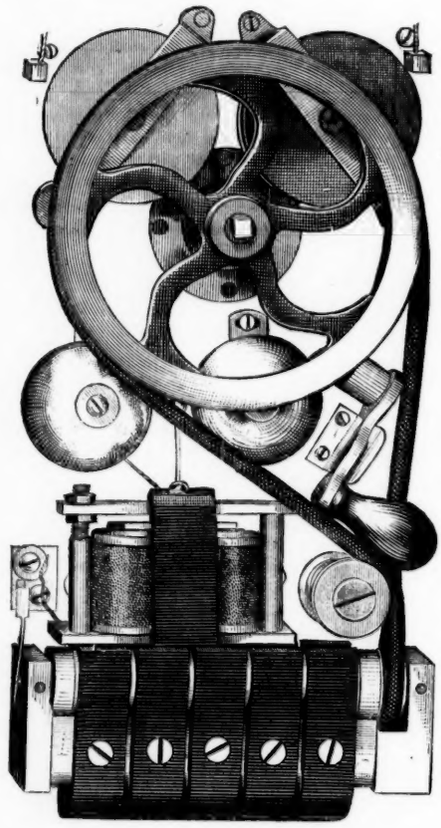
Fig. 6.

PORTABLE TESTING INSTRUMENT FOR ELECTRIC WIRES.

The hazards attending the use of the electric light have been over-estimated; not in matters of number or magnitude, but because too little account has been given of the preventable nature of such occurrences. With every element in an electric lighting system adequately insulated, and the lights properly protected, accidents to person or to property are improbable. If these precautions are disregarded, only good luck will avert disaster.

Two contacts are necessary to divert electricity from an electric lighting system. If one contact already exists and connects it with the earth, only one more contact is necessary to conduct a portion of the electricity from the system.

In such an event, if the electricity meets with a conductor of sufficiently high resistance, the electricity is converted into heat sufficient to burn any combustible substance which



is present. Formerly, ground return circuits were used, but this proved hazardous, even with ample conductors leading to the ground, and has been abandoned.

If an electric lighting system is sufficiently insulated when first arranged, there is no assurance that it will remain so, on account of the numerous changes, blunders, and accidents to which it is subjected. It is necessary that each system should be equipped with some means of ascertaining the condition of the apparatus each day before the electric lights are used. Unfortunately we are not forewarned of any lurking disarrangement of electric apparatus by means of any of the senses, in the same manner that leaking gas appeals to the sense of smell, or as leaking steam produces sound and vapour.

Means for the systematic trial of the insulation of electric lighting plant is as necessary as the gauge cocks to determine the height of water in steam boilers.

The most satisfactory method is to determine the resistance of the insulation by means of galvanometer and rheostat. But this involves delicate and expensive apparatus which cannot be used by any except an electrician, and its use is therefore limited to central stations of electric lighting companies, and is not feasible to apply for practical use in isolated plants.

A telephone will give indication of ground connections, but there is no certain knowledge of the limit of its work, and it may deceive the operator, as it is liable to be affected by induced currents, or by grounds from other electrical instruments.

The best method is by means of a magneto, which generates an alternating current and rings a bell, like the ordinary telephone "calls."

The engraving shows a portable apparatus, devised by C. J. H. Woodbury, of Boston, Mass., for the purpose of inspecting electric light apparatus under his charge.

It was very desirable that it should be as small as possible, and yet generate a current of sufficient tension to indicate a possible leakage of a sufficient quantity of electricity to cause damage. It consists of a Siemens armature in the field of a battery of five permanent magnets. There is no commutator, and the alternating current excites an electro-magnet which vibrates a striker between two small gong bells, in the usual manner. A polariser over the electro-magnet removes any residual magnetism. In the circuit, at the end of the case, are two reels, each of which carries forty feet of steel ribbon with spring clamps at the ends. These reels and the wheel which revolves the armature by means of a quarter turn belt are turned by a crank which fits like a clock key, and when not in use is held by a spring clip, as shown in the engraving. The armature is wound with No. 38 wire, and measures two and three-quarter inches long and three-quarters of an inch in diameter. The whole apparatus is contained in a mahogany case four inches wide, an inch thick, and eight inches long, and weighs twenty ounces.

The bell will ring, when the magneto is working, through an external resistance of four thousand ohms. A similar instrument for use on longer circuits has larger magnets and an armature of greater diameter, and rings through a resistance of eleven thousand ohms.

It was supposed that on long circuits the surface of the conducting wires might act as a condenser, and the static charge ring the bell, but such has not been the case even with circuits containing six miles of No. 6 wire. This instrument has been in constant use for over six months.

[We are indebted to the *Electrician* of New York for advanced proofs of this article and also for the block wherewith we illustrate the description.]

The Electric Light in Paris.—Some very successful experiments on the electric lighting of the *foyer* of the Opera House by the aid of Faure accumulators and Swan lamps took place last week at Paris. It is the idea to light the whole house by means of from 600 to 700 lamps of this system. The lamps were first shown to the public on Friday, September 29th. They have been placed in several parts of the building, but most prominently in the *foyer*, the extremely elaborate decorations of which have been entirely spoiled by the ruthless effects of gas. To light the *foyer* with gas 10 chandeliers, with 48 lights on each, were used, equivalent to about 4,800 candle-power. Two of these chandeliers have been fitted with 48 Swan lamps each; these were run up to about 40 candle-power, making a total of 3,840 candles for the two chandeliers, almost exactly equal to the eight remaining gas-lit chandeliers. The effect in the neighbourhood of the electric light was exceedingly marked, and the representatives of the Opera House, who witnessed the trial, expressed themselves extremely pleased with the result. We may add all the main cables were covered with lead, and every lamp was protected with lead "cut-outs," to avoid any possible chance of fire. The electric illumination of the shop of M. Sandoz, the well-known jeweller of the Palais Royal, has been discontinued, and doubtless will not be taken up again, at least under the same circumstances. This illumination was made with the aid of accumulators charged at the works and carried, insulated, to the Palais Royal. These unfavourable and uneconomical conditions are, we think, the cause of the discontinuation of this lighting. The Grand Café and the Théâtre des Variétés, continue their electrical illumination with the same success.

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CORRESPONDENCE.

TELEGRAPHING WITHOUT WIRES.

To the Editors of THE ELECTRICAL REVIEW.

GENTLEMEN,—With reference to the remarks that have been made by more than one of your correspondents upon my paper "On Recent Progress in Telephony," I think it right to say that I did not mean to imply that the experiment across the Solent was the *first* attempt to signal without wires across water, but that it was the first successful result obtained *by telephone*. In fact, I assisted Mr. Lindsay in 1854 in demonstrating the possibility of telegraphing across water in a large tank in the Electric Telegraph Company's stores in Lambeth, and I was aware that he had been anticipated by Vail in America, and, I think, also by Bain across the Serpentine.

Nor did I wish to assert that the very well-known fact of the lowering of the resistance of carbon by heat was a novelty, but that this effect was *one reason why* carbon is so much better than metals for microphones—an observation certainly novel, and derived from Mr. Shelford Bidwell.

W. H. PREECE.

DRY BATTERY.

To the Editors of THE ELECTRICAL REVIEW.

GENTLEMEN,—The perusal of a recent article upon the dry battery of Skrivanoff led to my calling upon Mr. Eldred, the courteous manager of the Globe Telephone Company, in Queen Victoria Street, who are the manufacturers. In response to my inquiry as to whether he could oblige me with a sample, he said they hoped very soon to be able to do so, and were confident of very good results. Noting my disappointment, he said he would give me one of those made in France, which were not so good as they would have shortly, if I would promise not to be disappointed at results, and give it a bad name. I assured him I would not, and in a little he returned with what appeared an ordinary electric bell push. It was a little heavier, but that was all the difference apparent.

Now for the results of the rough tests I was able to apply. Connecting it to an electric bell of the ordinary type, it was at once rung very vigorously. It did the same through five ohms resistance—all I had at command then. It gave a full deflection on an ordinary Clarke's detector, with 10° for quantity. Desiring to try a more minute test, I cut a cross section-piece from an electric light carbon (Brush's), about 1-16th of an inch thick. Soldering a wire to it, and also to a piece of zinc of a similar size, I took a very small portion of the paste from the battery and placed between the two, covering the whole with paraffine wax. I at once had one of the tiniest batteries, which gave a deflection on the galvanometer of 50°. With it I have been able to take a rough test of the continuity of an electric light circuit during the past week, besides the tests of incandescence lamps, and the many little things that are hourly wanted. It appears as efficient now as when I joined it up, its compactness, and the certainty of not spilling and spoiling, being great recommendations.

If you were to make a sandwich of two great pieces, with a piece of note paper between, you would get a good idea of the size of this tiny working battery.

For tests at a distance from stations it will be a boon to inspectors and all who have like work to do; besides, it can always be carried in the pocket-book, ever ready for use.

Yours, &c.,

S. V.

NOTES.

UNION OF THE THREE AMERICAS BY TELEGRAPH.—Panama, September 16th, 1882.—The cable steamers *Silvertown* and *Retriever* have returned and are now anchored in this bay, their work having been completed in the most satisfactory manner. The cable work and direction of the whole enterprise has been under the immediate care of Mr. Robert Kaye Gray, F.R.G.S., chief engineer representing the contractors, the India-rubber, Gutta-percha, and Telegraph Works Co., Limited, of Silvertown, London, England.

Mr. Joseph B. Stearns, a celebrated American electrician and the inventor of duplex telegraphy, is here representing the new cable company, whose title is the Central and South American Telegraph Company. Mr. Stearns, by the way, is well-known "at home" in Canada. His system is used by the Montreal Telegraph Company. He and Mr. Badger, of the Montreal Fire Telegraph Department, worked together before Mr. Badger left Boston to take up his residence in Montreal. Mr. Stearns has taken the position of general manager of the new enterprise *pro tem.* When all is complete he will hand over his charge to the president, and return to England, his present headquarters.

The cables laid by the *International*, *Dacia*, *Retriever*, and *Silvertown*, for the new company by the contractors' fleet, comprise some 3,200 miles of marine cable. The Central and South American Telegraph Company also have 313 miles of land lines working in connection with their cables as above.

The new company is American, and has its head offices in New York. The lines of the Mexican Telegraph Company run from Galveston, Texas, to Vera Cruz, Mexico, where the cable of the Central and South American Telegraph Company commences. The stock in both companies is nearly all held by the same shareholders. One president, Mr. James A. Scrymser, of New York, acts for both companies. The cables of the Central and South American Telegraph Company extend from Salina Cruz, in the Gulf of Tehuantepec, Mexico, on the Pacific side, to Lima, in Peru; there the cables of the West Coast of America Telegraph Company begin, and extend to Valparaiso, Chili, to be described later.

The connection of the Central and South American Telegraph Company with other ocean and land lines, will give a total mileage of over 20,000 miles, in Mexico, Central and South America, and with the Trans-continental line, an additional 6,250 miles, or in all 26,250. Here is a truly vast system of telegraphic connections just completed.

The three Americas are united by the cables of the Central and South American Telegraph Company for the first time. All honour to American enterprise.

Previous to the inauguration of the new company there was no direct communication by telegraph between these countries, as stated. For example, to send a message under the old *régime* to South America it had to be sent from New

York, *via* Newfoundland to England; thence by land lines and cables to Lisbon, Portugal, thence by cables to Madeira and the Cape de Verde Islands, and from the latter to Pernambuco, in Brazil. It will be seen that a message had to cross the Atlantic twice ere reaching the Atlantic coast of South America. Once there it could be sent up and down the coast by the cables of the Brazilian Submarine Company, from Para on the north, the neighbour of French Guinea, to Montevideo, in Uruguay, on the south; thence by a land line across the continent *via* Rosario, Mercedes, and Mendoza in the Argentine Republic, to Santiago and Valparaiso, Chili, thus reaching the Pacific or west coast of America, whence messages could be sent as far north as Lima by the West Coast of American Telegraph Company, an English corporation, whose manager is Edward William Parsoné. To fully illustrate how awkwardly people were placed in Panama and Callao when they had to cable to each other, the following will show. Let us suppose that A of Panama had to cable to B of Callao, distant only eight days by the English steamer. His message had to cross the Isthmus, thence to Jamaica, Havana, Key-West, to New York, thence *via* Newfoundland to England, over the Continent to Lisbon, from thence to South America, arriving at Pernambuco, thence *via* Montevideo across the Continent to Chili, thence up the coast to Callao, at an expense of nearly 13.00 dols. a word. It would have to travel over 14,000 miles of cable and 7,680 miles of land wire, in all nearly 22,000 miles—pretty well around the world. This was not only tedious and very expensive, but at times almost useless, owing to the land wires in South America being in a chronic state of "down," so that the mere paying for a message was often the easiest part of the whole affair. Such was not the exception, but the rule. Important messages often had to be sent on horseback across the wild pampas of South America. Now it is but fair to assume that under the new era these annoyances have been relegated to the past, and the Three Americas are in direct electric connection. Messages can be sent by either North or South America or the Isthmus of Panama, to Europe, or in a word, all over the inhabitable globe.

Now, how is all this done under the new order of things? Simple enough. A cablegram from either Mexico, Central or South America, on the Atlantic or Pacific side (in some places), can be handed into the office of the Montreal Telegraph Company "at home," or to any of the Western Union offices in the United States. It will then be forwarded direct to Galveston, Texas, thence by the cables and land lines of the Mexican Telegraph Company to Vera Cruz, Mexico, Atlantic side; thence it travels over the first section of the Central and South American Telegraph Company's cable to Goatzacoalcos a small Mexican village, situate at the mouth of the river of the same name, a distance of 138 miles, in the Gulf of Mexico; this section was laid by the contractors' steamer *International*, in March, 1881. The land line starts from Goatzacoalcos and crosses the Isthmus of Tehuantepec, a distance of 195 miles, and terminating at Salina Cruz, near the Mexican town of Tehuantepec, on the Pacific Ocean. Here the company are credited with having profited by the experience of the Western Union Telegraph Company, whose lines in the early days of telegraphy were of small wire, No. 16; these were often cut on the "wild prairie" by the gentle ravage of Uncle Sam's neglected family. A No. 9 or a layer wire was then employed that was practically useless to the red skin. The Central and South American Telegraph Company here "give one better," by using a No. 8, a larger wire having a greater message capacity.

To return to Salina Cruz. It is the northern terminus of the Central and South American Telegraph Company on the Pacific, and from it the first section of cable runs south a distance of 435 miles to La Libertad, in Salvador. At the latter port the company makes its first connection with the telegraph system of Central America. The names of the Central Spanish-American Republics now in direct communication with each other are as follows:—Guatemala, Honduras, Salvador, Nicaragua, and Costa Rica. The second section extends to San Juan del Sar, Nicaragua, a distance of 2,694 miles, and from the latter place to the Island of Pedro Gonzales, the distance to the island being 671 miles. The Island of Pedro Gonzales is in the Pearl Island group, nearly opposite the Isthmus of Darien. The Pearl Islands are known the world over for producing the largest and most valuable pearls. The Isthmus of Darien produces—well, crocodiles, india-rubber, big trees, and a *fever* that has been celebrated since the days of Patterson's colony. The name of Patterson is well-known to English readers as the founder of the Bank of England. His famous Darien scheme received the Royal sanction in 1695. Patterson landed 1,300 men in Panama, nearly all Scotchmen, who proceeded to the Darien to found his New Edinburgh. Between fighting the Spaniards, destitution and fever, the little colony was all but "wiped out." History informs us that but thirty reached Scotland, and of them says "they were too weak to weigh the anchor of the vessel which was to carry them home, and had to be assisted in their departure by the Spaniards." *Vide* Macaulay *et al.*

From Pedro Gonzales Island a section runs in back of the island of Toboga, one to Brighton, a distance of 49·4 miles to the city of Panama. The landing of the cable here, and its having been buried in trenches on its way to the company's Panama offices, has already been referred to in the *Gazette's* Panama correspondence. At Panama it connects with the Panama Railroad Company's telegraph, across the Isthmus of Panama to Colon (*vel* Aspinwall) on Navy Bay, Atlantic side, thence by cables of the West India and Panama Telegraph Company, an English corporation, to all its important West Indian Islands, as well as with British Guinea or South America. Messages can also be sent by the same company *via* Cuba and Key-West to Europe, as already described.

From Pedro Gonzales Island another section of cable runs a distance of 358 miles to Buenaventura, where it connects with the land system of the Columbian Government, estimated at 3,000 miles, the objective point of the latter being Sante Fe de Bogata, or the capital of the United States of Columbia, an all but inaccessible place away up in the mountains, 8,000 ft. above the sea level. It is more than a "Sabbath day's" journey to our Paris.

From Buenaventura another section extends 486 miles to Santa Elena, in the Republic of Ecuador. Santo Elena is nearly under the equator, and is at the mouth of the Guayaguil river; the city of that name is 111 miles up the river, and is the principal port of Ecuador. A land line runs from Santa Elena to the city, also belonging to the Central and South American Telegraph Company. If the writer is not mistaken, this is the first telegraph line in Ecuador—another triumph for American push and investment. Strange to say, Old England sells the world their cables. We may say without fear of contradiction that England is the sole manufacturer of cables. It is true that there is a manufactory for them in France, but it is a branch house of the company who took this contract; English cable ships, English cables, Englishmen, English capital, and English skill are always to the fore. Our American cousins show their good sense in purchasing from our common parent what they cannot produce themselves.

From Santa Elena a section runs to Payta; its length is 222·019 miles. Payta, as the readers of the *Gazette* are aware, is the principal northern port of Peru, and possesses great commercial importance. A Peruvian land line extends from Payta to Lima, its capital. The latter is wretchedly uncertain (not the capital, the line), and constantly "ailing." To avoid all difficulties, the Central and South American Telegraph Company have added a final section of 552·9 miles to Chorillos, within a short distance of the capital. A land line of the Central and South American Telegraph Company, seven miles long, connects Chorillos with Lima. Lima is the southern terminus of the new company, and the northern terminus of the West Coast of America Telegraph Company, the cable of the latter, as already said, extends 1,699 miles to Valparaiso, Chili, touching the coast of Peru, at Mollendo, Arica, Iquique and Autopogasta, formerly Bolivia's only seaport, thence to Caldera, Sarena, and Valparaiso. From Valparaiso a land line—that referred to—stretches across the vast continent, thus the Transandine Telegraph Company is a Chilian corporation. We, of the Pacific coast, thanks to the new company, can now send our messages to Europe by three different routes. If the cables and lines were clear, a message could be sent from your correspondent's office in Panama, around the world and back to himself in a very few minutes. It would travel some 26,000 miles *via* Chili and Uruguay to Europe and back *via* Montreal, Texas, and Mexico to the Isthmus of Panama.

The mind is all but dazed when one commences to contemplate what skill and capital are daily accomplishing in this great world. The tendency of the whole is to benefit mankind and advance civilisation. The millennial period of "plough shares, pruning hooks, &c.," is left for the future, as well as several letters on cables, cable ships, and cable laying, to be written in an everyday way for everyday readers.—*Montreal Gazette*, September 25th.

THE CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY'S CABLES.—The India-rubber, Gutta-percha, and Telegraph Works Company notify that the cables manufactured and laid by them for the Central and South American Telegraph Company between Vera Cruz, Mexico, Panama, and Lima, in Peru, with intermediate stations at Goatzacoalcos, Salina Cruz, Port Libertad, San Juan del Sur, Buenaventura, Santa Elena, Payta, and Chorillos, were opened to the public on Saturday, the 7th inst. These lines, some 3,200 miles, with the 1,700 miles of the West Coast of America Telegraph Company, extending from Lima to Valparaiso, with intermediate stations at Chorillos, Mollendo, Iquique, Arica, Antafogasta, Caldera, and la Serena, and the 740 miles of the Mexican Telegraph Company, between Vera Cruz and Galveston, with an intermediate station at Tampico, make 5,640 miles altogether, made and laid by this company between Valparaiso and the United States of America.

THE STEAM-SHIP "SILVERTOWN."—We read the following in the Panama *Star and Herald*:—

"Independently of the interesting fact that the *Silvertown* is a magnificent cable-ship, with all the necessary appliances and improvements used in laying the submarine telegraph lines, she is a comfortable and spacious vessel, having an elegant saloon, chastely furnished and cabins well ventilated, affording every comfort.

"During the recent earthquakes this fine steamer became the hospitable roof of many of Mr. Robert Gray's friends. The acting British Consul, with his family, as well as many English and French residents, during the panic had recourse to Mr. Gray's kindness, who most generously entertained them on board. The guests were taken from shore by the steam-launch of the *Silvertown* and received on their arrival by the officers and crew, who were most attentive. Several fine cabins were placed immediately at their disposal, amongst which Mr. R. Gray generously offered his deck-cabin and office, which had to be accepted. This cabin, ventilated to perfection, is most charming; it has a fine spacious berth, a library containing the latest books, newspapers, and periodicals, a bathing apparatus of no small dimensions, and several hammocks hung in different directions of the vessel to accommodate those who preferred reposing on deck and in the open air.

"Thus sleeping was assured with every comfort, as one can perceive, the victualling department provided the guests with everything that could be desired. The meals were thoroughly enjoyed by every one present, and the remarks made were that not only were they safe from falling *débris* and fright, but also that the benefit derived was surprising by the charming change and company.

"Now that the *Silvertown* is about to leave for San Francisco, where she will receive a cargo and return to England, it may be confidently assumed that the great scientific undertaking of laying the cables for the Central and South American Telegraph Company has been satisfactorily accomplished. Indeed, the employés on the *Silvertown*, and the operative staff of the company, are unanimous as to the admirable manner in which the cable has been laid—a fact which was proved by a final test which took place yesterday. The credit, of course, is due to the entire cable staff, under the guidance of Mr. Robert K. Gray, who has deservedly received congratulations from a large circle of friends at home and abroad. It is expected the lines will speedily be opened to the public for business, and then direct communication will be available to every town or port of importance north and south of the Pacific coast, and transmission to all parts of the world where lines are laid—a boon which cannot fail to be appreciated by the public at large. It is a fact that signals through 1,600 miles of direct cable have been exchanged with remarkable distinctness.

"The offices at the various stations along the company's route are all in readiness for work. The Panama office, which, we understand, is to be the head-quarters of the Central and South American Telegraph Company, has been rapidly transformed into a suitable set of offices since the arrival of the traffic manager (Mr. C. J. Murphy), who, in conjunction with the general manager, Mr. J. B. Stearns, has been most assiduous in making necessary alterations for the public benefit, and who has also an efficient staff of operators ready to carry on the work of the office."

TELEGRAPHIC INVESTMENT COMPANIES.—The London *Times* of Wednesday, in a leader, says: By some investments of money, whether the subscribers gain or lose, the world must profit. Among speculations of this infallible kind the enterprise of the Central and South American Telegraph Company and the Mexican Telegraph Company ranks high. They are companies doing business at New York, and under American management. No State aid has been granted or, so far as we know, been solicited by them. Out of their own resources, and in reliance on calculation of returns which there is no ground to presume will prove untrustworthy, they have spent nearly a million sterling in filling up the gaps in South and Central American telegraphy. At Callao, the port of Lima, the telegraphic chain up the west coast of South America has hitherto terminated. To the imagination of the engineer and to the practical judgment of the merchant, the huge stretch northwards with the Republics, long ago deserted even by financiers, has been a wilderness isolated from civilisation. Last spring the steam-ship *Silvertown* started with several thousands of miles of potential lungs and voices for the inarticulate shores of the Pacific. The operation is already accomplished. The rill, as it were, of South American utterance falls into vast and loquacious sea of Western Union telegraphy, which spreads it over the univere. Intercourse among the South and Central American States has been confined hitherto chiefly to war. The populations which inhabit them have had no easy avenues of communication, and have felt no especial desire to construct them. Telegraph stations, uniting at a multitude of points, will tempt them to an acquaintance which may lead to friendship.

NEW CABLES.—We have reason to believe that the Great Northern Telegraph Company are making the necessary preliminary arrangements for the duplication of all their cable lines in the Far East, to be effected at a very early date. This to meet more readily the exigencies of the increased Chinese and Japanese traffic, both local and international.

CABLES INTERRUPTED.—The cable between Guadaloupe and Dominica is interrupted. There is at present no telegraphic communication with the islands of St. Lucia, Martinique, St. Vincent, and Barbadoes.

CABLE REPAIRED.—The cable between Amoy and Hong Kong is repaired.

TELEGRAPH CABLE SHIP FOR THE POST-OFFICE.—We learn that Messrs. David J. Dunlop & Co., Glasgow, have contracted with the Post-office authorities for a cable ship.

TELEGRAMS FOR JEDDAH.—The Post-office gives notice that a cable has been laid between Souakin, in Egypt, and Jeddah, in Arabia, and that telegrams can now be accepted for transmission to Jeddah.

ELECTRIC LIGHTING.—The *Athenæum* says: "Among other improvements about to be made at the National Library at Paris, it is hoped that the electric light may be successfully introduced."

THE Peterhead Police Commissioners have resolved that the electric light shall not be supplied to their town by any company. They are the owners of the gas works.

THE *Newcastle Daily Chronicle* says: "The electric lighting at the Tynemouth Exhibition is now perfect."

THE electric lighting of the galleries of the Dundee Fine Art Exhibition is a great success.

THE Hamilton Town Council at their monthly meeting had before them notifications from three electric lighting

companies. They resolved to meet specially on Thursday to consider whether the burgh should not apply for an Order.

The Conway Town Council have agreed to inform all electric lighting companies that they are fully prepared at the proper time to oppose applications for Provisional Orders to supply the electric light within their jurisdiction.

The New York correspondent of the *Standard*, telegraphing on Sunday evening, says: "The danger caused by the current of electricity escaping from the underground wires has excited much comment of late, and a fire which occurred in a suburban church is attributed to this cause. Mr. Edison asserts that his household system has proved an entire success, but the remark is made that the loss of the current has prevented his service being supplied to more than fifty houses."

The following letter from the Town Clerk of Glasgow was read at the Town Council meeting on Monday: "The Gas Committee, acting under remit from the Town Council, have resolved to recommend to the corporation to apply for a Provisional Order to enable them to supply electric lighting to the city. This recommendation will be considered at a special meeting of the Council to be held on the 19th inst. In the meantime I am in communication with the town clerks of Manchester and other burghs in England, with a view to joint action on an uniform basis, to resist all applications by outside electric lighting companies, and to promote the requisite order in as complete a form as possible on an uniform basis."

The Pollockshields Commissioners have remitted the several notices on electric lighting sent them to the Lighting Committee, and declined to give an opinion on the matter at present.

The Rutherglen Town Council have passed the letters addressed to them by electric lighting companies to their Lighting Committee for consideration.

The Broughty Ferry Commissioners at their monthly meeting, on Monday, had before them a letter from the secretary of the Northern Electric Light, Power, and Appliances Company as to supplying electric light. The clerk was instructed to reply that the commissioners intended to move in that direction themselves.

A Committee of the Salford Town Council, on Monday, decided to recommend the Council to consider the expediency of adopting a resolution authorising and directing an application to the Board of Trade for a Provisional Order empowering the Corporation to supply electricity for public and private purposes within the area of the burgh; and, further, to direct the Town Clerk to give a month's notice pursuant to the Electric Lighting Act, 1882, for the purpose of considering the applications of various companies for Provisional Orders, and to oppose or support the same, as the Council may determine.

A motion proposing that it be remitted to the Lord Provost's Committee to consider whether the Council already possesses power to supply electric light, or whether supplementary powers be sought, was unanimously adopted by the Edinburgh Town Council at their meeting this week.

The Brush Electric Light.—At a fancy bazaar held on the 5th, 6th, and 7th, in the Kinnaird Hall, Dundee, four Brush arc lamps of 2,000 candle-power each were hung from the roof of the hall, diffusing a powerful light on the quaint scene below, which was a representation of a Swiss village market-place. The roofs of the huts were coated with white wood, to give a winter appearance to the spectacle, and the light was well reflected through the entire hall, owing to this. Outside the door, suspended from ornamental brackets, were another two lamps, the light of which illuminated the greater part of Bank Street, and attracted much attention from the passers by. Every one that saw the lights seemed highly satisfied with their brilliancy and steadiness, and were of opinion that the Brush system would take well in Juteopolis. The installation was fitted up by the Brush Electric Light and Power Company of Scotland, Limited.

Electric Lighting at Chesterfield.—It will be remembered that we fully described the electric lighting of Chesterfield, as far as it had then been accomplished, in the Electrical Review of April 15th. The following letter appeared in the *Standard* of last Thursday: "At this time, when the question of lighting by means of electricity is receiving so much attention, and as Chesterfield is the only town in England whose lighting is done throughout by electricity, it may be interesting to your readers to know what our experience has been.

"I need not detail the stages which led to our abandoning gas, and taking up the electric light after being in darkness some months. I may briefly state that, after going carefully into the question, we decided to adopt the system whose praise was in every one's mouth a year ago, namely 'The Brush,' and, though we were applied to by other companies, we placed the execution of the work in the hands of the one that we considered the most suitable—the Hammond Company. During the negotiations of the contract, Mr. Hammond particularly pressed us not to stipulate for incandescent lamps, as he acknowledged that their company were not in a position to cope with incandescent lighting for public purposes. We, however, decided upon the town being lighted with the Lane-Fox incandescent lamps, as well as the Brush arc lights.

"After waiting many weary months for the completion of the incandescent lighting, it is now, when declared by the contractors complete, in my opinion a decided failure. The Lane-Fox lamps, which have been supplied by the Brush Company, are most variable in their lighting power; whilst some are good, others only give a feeble light instead of a light equal to that of fifteen candles, as expected. The arc lights are doing good service in some of the large streets, but as a whole I think it has been fully demonstrated in a year's trial in Chesterfield that the field for arc lighting is very limited indeed.

"Though the tradesmen have been canvassed by the Hammond Company with a view to introducing the arc lights into their shops and hotels, in not one single case has the light been adopted. Indeed, it is evident to us who have them under our eyes every night that they are only fit for lighting works and large open spaces. The experience that has been thus gained at Chesterfield at the present juncture must be of value to all towns intending to adopt the electric light, and is my reason for troubling you with this letter, although I believe the time will shortly come when lighting by electricity may be advantageously adopted both for public and private purposes.

"GEO. EDWD. GEE, Alderman of the Borough of Chesterfield."

Two Estimates for Incandescent Electric Lighting:—Lancashire Maxim-Weston Company:—

2,000 lamps	£500
Renewals (? per ann.)	500
Dynamo machines	4,000
Engines	2,500
Cable	1,000
Fittings and extras	500
	£9,000

The "Ferranti" system:—

1 Dynamo machine	£1,200
2,000 lamps	500
Sockets for above	100
Speed Indicator	6 16
Packing, fixing, erecting, instruction, &c.	300
	£2,106 16

Steam-power is not included here, nor the cost of cables, but taking the high figures for these items as given in the Maxim-Weston Company's estimate, we must add to the above £3,500, making a total of £5,606 16s. 0d., as against £9,000 for precisely the same work.

Sheffield and the Electric Light.—We hear that the Corporation of Sheffield has decided to undertake both the public and private lighting of this important town by means of electricity; and an application for the necessary powers will be made to Parliament as early as possible in November. Mr. Conrad Cooke, so well known through his connection with our contemporary, *Engineering*, the recent telephonic law-suits, electric lighting, and scientific matters generally, has been appointed consulting engineer and scientific adviser

to the Corporation. It would be hard to find a gentleman more thoroughly conversant with electric lighting than Mr. Cooke, he having been practically connected with the subject since the first "Gramme" dynamo-electric machine was brought to this country. The preparation of the elaborate scheme upon which he will shortly be engaged, should the matter of lighting Sheffield by electricity be carried through, as no doubt it will, is no *light* task; and we congratulate Mr. Cooke on his being selected for this most important work, feeling assured that it will redound to his own credit, as well as ensure the success of the undertaking.

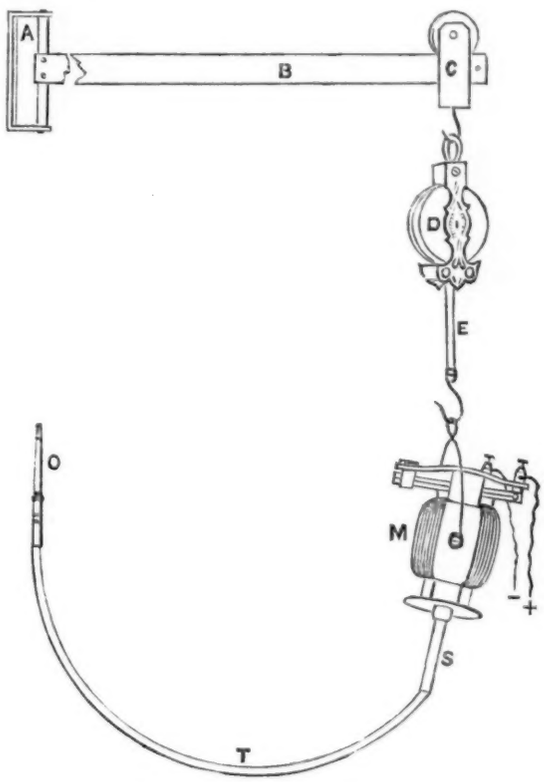
Electrical Engineering.—Classes for instruction in electrical engineering are to open on the 23rd inst. at the works of the Railway and Electric Appliance Company, Polmadie. Mr. Rankine Kennedy is to conduct the classes.

The Owens College, Manchester.—Professor Arthur Schuster, assisted by Mr. W. Haldane Gee, will give a theoretical and practical course on the technical applications of electricity, including the first principles of Electrical Engineering, on Thursday evenings, from seven to nine o'clock, in the Physical Laboratory. The following is a short syllabus of the class, which may, however, be subject to some variations. Measurements of current, electromotive force, and resistance. Current producers: the Daniell, Grove, Bunsen, Leclanché, &c., elements. Standard cells, how to prepare. Current measurers: the vertical detector, the astatic galvanometer, differential winding, the tangent and sine galvanometers, Thomson's reflecting galvanometers. Units of resistance: the B. A. and Siemens units, manufacture of cheap resistances, arrangement of resistances in coils. The exact measurement of resistances. Condensers. Construction of telegraph lines, measurement of current, localisation of faults, testing of insulation and conductivity. Duplex telegraphy. Submarine telegraphy: the tests during the construction of the cable. Telephone, microphone, induction balance. Magneto and dynamo-electric machines, description and comparison of different systems. Electrical lighting: testing of strong currents and electromotive forces, different systems of lamps. Photometers. Description of electro-motors and electric railways. The class will have at its disposal a Wilde dynamo-electric machine, which when worked by the college engine may be arranged to produce either direct or alternate currents. In the electric light measurements students will have the opportunity of personally using instruments of recent design, such as those of Professors Ayrton and Perry, Sir William Thomson, and Dr. Siemens. The fee for the class is £2 2s. Students desiring to attend are requested to communicate as soon as possible with Professor Arthur Schuster, at the college.

Electrical Exhibition.—The Electrical Exhibition at the Westminster Aquarium, which it is now arranged shall be opened on December 1st, is, we are informed by Mr. Gooch, likely to be a great success. The entries of motors, to which just now public interest seems attached, will be large and interesting. Electric light entries are also numerous and representative. The matter of distribution seems to have received attention, and the different systems will find many exponents. The Edison electric light will form a very attractive feature as usual.

Lightning Conductors.—The Lancashire and Yorkshire Railway Company have, through their telegraph superintendent and engineer, received specifications and estimates for new lightning conductors for their carriage works at Newton Heath, and decided to use the system for which Messrs. James Davis & Co., of Bradford, received the prize medal at the Crystal Palace International Electric Exhibition, 1882.

The Griscom Motor.—An exceedingly useful application of this motor to dental operations may be seen at the London office of the Electro-Dynamic Company of Philadelphia. The engraving shows the general arrangement of the apparatus. A wall-bracket, A, carries a movable beam, B, along which a travelling roller, C, may be pushed to any desired extent. This roller carries a little circular case, D, precisely similar to an ordinary spring tape measure. From a brass tape, E, is suspended the Griscom motor, M, which may be adjusted to any position. On the end of its axle a flexible steel wire shaft, T, is coupled by means of a connecting piece, S. At the end of T is the drill, O, and on



applying the battery current to the terminals of the motor this drill is made to revolve at about 4,000 revolutions per minute. The flexible shaft may be placed in almost any position, and indeed it has been worked when twisted loosely up into a single knot. The complete apparatus may be shifted about to suit all circumstances, and the combination is certainly very neat. We should imagine that this application of electricity will meet with great favour not only amongst dentists but wherever drilling on a light scale is required.

The Coercitive Force of Steel rendered Permanent by Compression.—This is the title of a very interesting paper, presented by Mons. L. Clémandot to the Académie des Sciences on the 2nd of October. The result obtained by M. Clémandot is as follows: When steel is tempered by compression, that is to say, when it is cooled under pressure after a quick cooling, obtained partly by compression, the coercitive property of steel is maintained, notwithstanding the reheating and even forging; it is permanent and indelible whatever be the subsequent operations to which it is submitted. Whilst steel tempered in a bath is hard, unworkable, and often distorted, compressed steel can be worked up again as if it were soft; it can be filed, drilled, &c., which is an inestimable advantage for manufacturers of magnetic apparatus, magneto-electric machines, telephones, &c., who often lose valuable time by working upon magnets which break at the last moment. M. Clémandot's paper seems to us to have a special bearing, and it would be very important to know if steel prepared by his method really possesses the permanence which the author attributes to it; we could, if it is so, construct ampèremeters and voltmeters with permanent magnets, whose constancy and exactness would leave nothing to be desired. We hope that the Commission charged with the examination of the researches of M. Clémandot, and composed of MM. Dumas, Boussingault, Fremy, Debray, and Breguet, will not delay its opinion upon this important question.

International Electrical Conferences.—Two international conferences will open in Paris on Monday next. One of these is for the object of settling upon a plan for the protection of submarine telegraph cables, the other is to re-establish throughout Europe the important desideratum of technical uniformity in relation to electricity. England, France, Germany, Austria, the United States, Spain, Denmark, Norway, and Sweden, will be represented. Mr. Kennedy, C.B., of the Foreign Office; Mr. Trevor, assistant secretary to the Board of Trade; and Mr. Patey, third secretary to the Post-office, have been appointed to be the delegates of her Majesty's Government relative to the Protection of Submarine Telegraph Cables, and Lieutenant-Colonel Bateman-Champain will represent the Government of India. Mr. H. Farnall, of the Foreign Office, has been appointed secretary to the delegates.

Hydrodynamic Experiments imitating by Means of Liquid or Gaseous Currents the Magnetic Shadows obtained with Electric Currents or Magnets.—By M. C. Decharme.—1. In order to imitate hydrodynamically the lines of force of an electric current in a plane perpendicular to its direction, it is sufficient to blow gently through a tube drawn out to a point, a continuous current of water perpendicular to a plate covered with a thin layer of red lead stirred up in water, the point of the tube being fixed at a few millimetres distance from the plate. We thus obtain around the point of impact a considerable number of concentric circles, formed of particles in juxtaposition, in the manner of iron filings under the influence of a strong electric current.

2. In order to obtain lines of force imitating those of an electric current, but in a plane parallel to its direction, it is necessary to use a current not of water but of air. We blow upon the stratum of red lead through a pointed tube held vertically. During this time we transport rapidly the tube parallel to the plate, spreading out the current, so to speak, horizontally. We obtain thus very short straight lines, very close together, perpendicular to the direction of the current, and like those given by an electric current laid upon a sheet of white paper dusted over with iron-filings.

3. To imitate the lines of force of two currents in the same direction, in a plane perpendicular to their direction, two tapering tubes are required containing water, into which the operator blows simultaneously. They are soon closed at the same time before the liquid contained in each of them is exhausted. Thus two systems of curves are obtained, which repel each other when they meet, as occurs with iron-filings under the influence of electric currents.

4. The imitation of the lines of force of two currents in opposite directions, in a plane perpendicular to their direction, presents real difficulties, it being necessary to find a practical means of producing the effects of polarity. Among those which I have devised, and which are described in my memoir, I will cite the following: I make use of two glass tubes, the one drawn out fine, to spirt the liquid by compressing a caoutchouc globe attached to its upper extremity, the other wider (a straight pipette), serving to aspire the water and the red lead. By the simultaneous action of the two tubes suitably fixed, the first at a few millimetres from the plate, and the other in contact with the red lead, we produce a figure which shows the two effects of contrary polarites.

As for the imitation of large magnetic shadows produced by isolated or combined magnets we employ means differing little from the former and tubes which are not drawn out. My memoir contains the details of each particular case.

We can thus produce hydrodynamically various effects which are imitations of numerous sorts of magnetic shadows, known or capable of being realised.—*Comptes Rendus.*

A Hot Electro-motor.—By Signor Gandini.—The author employs an element heated to about 212° F., a cylinder of zinc in a solution of salt, and carbon in a solution of potassium chromate with sulphuric acid. The electromotive forces, E, and the resistances, R, are

Cold: E = 2·10 volts. R = 0·82 ohm.
Hot: E = 2·44 „ R = 0·71 „

The polarisation is smaller at higher temperatures; the element is very constant.—*Wiedemann's Beiblätter.*

NEW COMPANY REGISTERED.

The Electromotive Force Company (Limited)—capital £25,000; offices, 6, South Hanover Street, Glasgow; Secretary, D. Johnstone Smith—was registered on September 18th. The company purposes carrying on the business of general electrical and mechanical engineers, and commences operations with four of Mr. Alfred R. Bennett's patents, two of which are for galvanic batteries, one for a new method of preventing corrosion in boilers, and the fourth for telephonic repeaters or translators. Mr. Bennett's battery was fully described in our issue of February 18th, since which date it has been improved and employed in actual work with considerable success, as have also the telephonic repeaters. Mr. Bennett will act as manager to the new company, retaining, however, his appointment as engineer to Messrs. D. and G. Graham.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

The following returns have been recently filed:—

Anglo-Colonial Electric Light Company (Limited).—A special resolution, passed at a meeting of the shareholders of the above company, held on August 14th, and subsequently confirmed, was filed on the 11th ult., and authorises the transfer of the goodwill, patents, and all rights and interest to the Laing Electric Light and Power Company (Limited) in consideration of £45,000 in fully paid shares in that company. The last return of the Anglo-Colonial, made up to December 23rd, 1881, was filed on 31st of the same month. The nominal capital of £8,000, in £1 shares (fully paid), being divided amongst 17 members.

British Insulite Company (Limited).—The return of this company, made up to July 13th, was filed on the 24th of that month. The nominal capital is £250,000, divided into £24,900 A shares of £10 each and 1,000 B shares of £1 each. 11,782 A and 1,000 B shares have been allotted, £5 per share being called upon the former, the latter being issued as fully paid up. The calls paid on the A shares amount to £58,870, leaving £40 unpaid.

South African Brush Electric Light and Power Company (Limited).—The return, made up to July 31st, was registered on August 5th. The nominal capital is £100,000, in £5 shares. 20,000 shares have been taken up and £2 10s. per share called thereupon. The calls paid amount to £48,179 and unpaid to £1,821.

Pilsen-Joel and General Electric Light Company (Limited).—The return, made up to 25th ult., was filed on the 3rd inst. The nominal capital is £200,000, in £5 shares. The number of shares taken up is as follows: 28,000 with £2 paid and 11,470 with £5 paid. The calls paid amount to £55,925, and considered as paid to £57,350, and £75 remains unpaid.

Metropolitan (Brush) Electric Light and Power Company (Limited).—The return, made up to August 25th, was filed on the 7th ult. The nominal capital is £1,000,000, in £5 shares. 99,694 shares have been taken up and £3 per share called thereon. The calls paid amount to £296,157 and unpaid to £2,925.

Electrical Association (Limited).—The nominal capital of this company is £50,000, in 100 shares of £500 each. The return, made up to August 28th, was filed on August 29th. The whole of the shares have been taken and £125 per share has been called. The call has been met to the extent of £10,000, leaving £2,500 unpaid.

Anglo-Pacific Electric Light, Telephone, and Power Company (Limited).—The return, made up to the 28th ult., was filed 9th inst. The nominal capital is £300,000, in £5 shares, but the seven shares taken by the signatories to the memorandum and articles of association are all at present issued.

Birmingham and Warwickshire Brush Electric Light and Power Company (Limited).—The return of this company, made up to the 3rd inst., was registered on the 9th inst. The capital is £100,000, in £2 shares. 37,841 shares have been issued and £2 per share called. The calls paid amount to £30,428 10s., and considered as paid to £45,000, leaving £253 10s. of calls unpaid.

NEW PATENTS—1882.

4717. "Dynamo and magneto-electric machines and electro-motors." J. Gordon and J. Gray. Dated October 4.

4718. "Improvements in and connected with electric railways, which improvements are in part applicable to other electrical purposes." J. Hopkinson. Dated October 4.

4735. "Secondary batteries." C. F. Kingzett. Dated October 5.

4738. "Meters for recording quantity of electricity." A. E. Porte, J. Lesware, and J. Chancellor. Dated October 5.

4740. "Call apparatus for telephone lines (switches, armatures, magnets, &c.). M. Benson. (Communicated by J. P. Stabler.) Dated October 5. (*Complete.*)

4752. "Intensifying fluorescent or phosphorescent electric lighting, whereby the same is rendered serviceable for illuminating purposes, and apparatus for effecting the said intensification. R. Kennedy. Dated October 6.

4756. "Secondary voltaic batteries." A. Khotinsky. Dated October 6.

4764. "Electrical apparatus for the propulsion of boats." A. Reckenzaun. Dated October 6.

4768. "Covering wire for electrical purposes." J. J. C. Smith. Dated October 7.

4771. "Production of electric light and means to be employed for the purpose." O. G. Pritchard. Dated October 7.

4777. "Mechanism or apparatus for electrical communication on railways." R. Tatham. Dated October 7.

4778. "Telephones." H. B. T. Strangways. Dated October 7.

4780. "Electric lamps or lighting apparatus." S. F. Walker and F. G. Olliver. Dated October 7.

4787. "Machines for moulding pipes or tubes from plastic material and for covering telegraph cables or the like." J. H. Johnson. (Communicated by G. F. Lufbery.) Dated October 7.

4809. "Secondary batteries." R. Tatham and A. Hollings. Dated October 10.

4810. "Dynamo-electric machines." R. E. B. Crompton and G. Kapp. Dated October 10.

4816. "Voltaic batteries." E. J. Wimshurst. Dated October 10.

4819. "Dynamo, or magneto-electric machines." W. R. Lake. (Communicated by J. Wenström.) Dated October 10.

4824. "Incandescent lamps used for the purpose of electric lighting." E. Muller. Dated October 11.

4829. "Electric switch for electrical lamps and other purposes." G. W. Bayley. Dated October 11.

4832. "Telephones." J. H. Johnson. (Communicated by L. de Locht-Labye.) Dated October 11.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

1882.

941. "Electrically controlling, &c., the speed of engines, &c." J. Richardson. Dated February 27. 6d. This invention relates to certain improvements connected with the invention patented by the inventor on the 22nd day of January, in the year 1881, No. 288, for apparatus for controlling and regulating the speed of engines employed in driving dynamo machines. According to the present

Fig. 1.

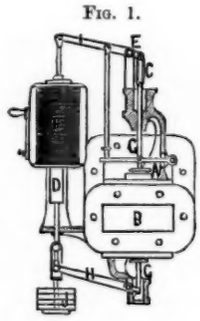


Fig. 2.

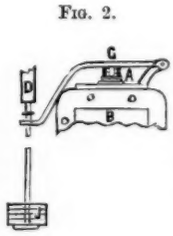
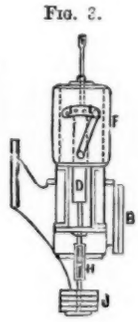


Fig. 3.



invention, shown in front and end elevation respectively by figs. 1 and 2, the solenoid is connected with the valve, B, by fixing the lever, H, under the valve to draw the valve downwards instead of forcing it down and thus get the stalk, G, of the valve in tension instead of compression; by this means its diameter and therefore its friction in the stuffing boxes is very much reduced. This thin stalk, G, is made of steel or of phosphor bronze, and is carried upwards through the stuffing box, A, connecting its upper end by means of a flexible cord or a steel band, C, either to the arm, E, of a lever (upon the long arm, I, of which is hung a weight, J, or passed round a pulley on the opposite side of which is hung a weight), or it is connected directly to a strong spiral or other spring, the object being to lift the valve upwards to open it in opposition to the force of the solenoid tending to close it. Simple means are also used to prevent the engine chasing, thus dispensing with the second electro-magnet now used for that purpose, utilising instead the weight of the core of the solenoid, to which core is attached a brass rod and balance weight, as at fig. 3.

1002. "Electric rotary hairbrush." H. Liesner. Dated March 2. 2d. The inventor constructs the axle upon which the brush turns of wood or any other suitable substance; this axle is covered with leather or other suitable substance; the axle is constructed of larger diameter than those in the ordinary revolving brushes. The cylindrical frame upon which the bristles are fixed is constructed of vulcanite or other suitable dielectric substance or substances. On the inside of the frame of the brush are suitable grooves, and into these grooves are fitted metal wires. These wires are carried to the outside of the frame of the brush into grooves on the outside of the frame of the brush, where they are insulated. The ends of these wires are brought up among the bristles and, preferable, the ends terminate at about half the length of the bristles. The friction caused by the revolution of the brush on the axle sets up a current of electricity which is conveyed by the embedded metal wires to the ends of the wires among the bristles, and thus brought into contact with the hair. (*Provisional only.*)

1017. "Insulating apparatus for overhead telegraph lines, &c." J. S. Lewis. Dated March 3. 6d. The object of this invention is to produce an insulator to which the wires shall be easily, quickly, and effectually affixed, and consists in forming the top of the insulator in the shape of a screw gradually expanding in its diameter, something after the manner of a gimlet end only with a more rapid increase in diameter. To this the wire is fixed by means of a metal shackle or clip of stout round wire, formed in the shape of a horse-shoe to fit round the insulator and having a hook at either end to fasten round and clamp the line-wire. By hooking this shackle on to the wire and screwing the screw formed on the (loose) insulator into this ring till it is tight, and then fastening the insulator bolt tight on the telegraph arm or bracket, the wire is secured. Fig. 1 is elevation of

Fig. 1.

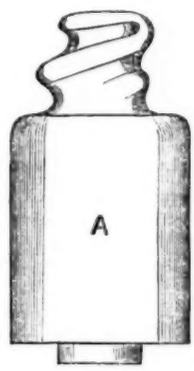
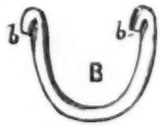


Fig. 2.



insulator and fig. 2 shows the shackle or clip for attaching the wire thereto. In these A is the insulator, B the shackle or clip, *b* hooks on shackle B. In fixing telegraph wires the line-wire is attached to the insulator by means of the shackle or clip, shown in fig. 2. The hooks, *b*, pass round or hook on to the line-wire, and enclose the insulator, A, between the wire and the partial ring formed by the shackle, B. By turning the insulator (which is left loose in the arm on the telegraph post or bracket) round and screwing it into the ring thus formed (the screw being a gradually expanding one, as shown) the insulator is wedged tightly into the ring. The insulator can then be rigidly fixed in position by means of a bolt or stud cemented into and projecting from it in the ordinary manner. The patent also relates to the method of forming the screw on the insulator.

1020. "Apparatus for transmitting and receiving sound." J. Rapieff. Dated March 3. 6d. For the purpose of increasing the distinctness and intensity of transmitted sounds, the inventor proposes to use a microphone having two or more groups of contacts, parts or branches, arranged in such a way that the vibrations set up by the sound-waves in one or several of these groups will increase or decrease the pressure of the contacts, and consequently decrease or increase their resistance, while the contrary effect will be produced in the contacts of the other group or groups, and he connects these different groups of contacts, parts or branches of the microphone to separate wires, or parts of the primary coil or coils of an induction bobbin, in such a way that the effect of a divided current from a battery, passing through this arrangement of microphone's contacts and primary coil or coils, when the microphone is at rest, shall produce little or no magnetisation of the iron core in the induction bobbin. The result of this arrangement will be that when the sound-waves or vibrations act on the microphone, the added, or double effect of the changes of the microphone's contacts, pressure, and resistance will produce a differential action of the current on the primary coil or

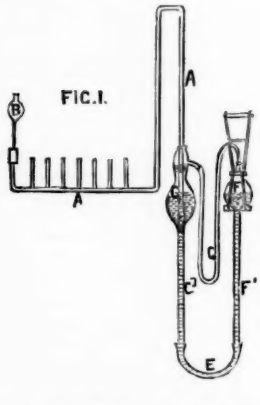
coils, and consequently will effect a greatly intensified variation of the magnetisation of the iron core and the induced currents in the secondary coil or coils of the induction bobbin. For obtaining the same result any similar disposition of the microphone's contacts in connection with the induction bobbin can be used, as for instance, the groups of the microphone's contacts may be inserted in the sides of a Wheatstone bridge, while the primary coil or coils of the induction bobbin are placed in the bridge itself.

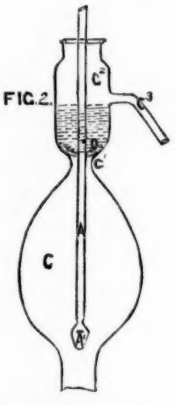
1023. "Indicating and regulating the current of electric generators." T. J. Handford. (A communication from abroad by T. A. Edison, of America.) Dated March 3. 8d. The object of a portion of this invention is to produce devices to be used in connection with dynamo or magneto-electric machines and electric lights, which will notify the engineer when the lights are above or below the desired limit of candle-power, so that he can regulate the generative capacity of the machine or machines in accordance therewith, and also to produce other devices which will prevent injury to the machine or machines when an abnormally large current is caused to flow by the addition of more lights than the plant has capacity to furnish, and will at the same time notify the engineer of the condition of affairs. It consists principally of a relay in a shunt circuit, whose tongue plays between two contacts. An increase in the current deflects the tongue against one contact and rings a bell, whilst a decrease in the current deflects it against the other contact and rings the same bell through a resistance, producing a feebler sound.

1024. "Construction and working of switch apparatus for telegraphic or telephone exchanges, &c." W. E. Irish. Dated March 3. 8d. Relates to certain improvements in or connected with the construction and working of junction or switch apparatus specially applicable for use in telegraph or telephone exchanges or stations, or for other similar or equivalent uses in which it may be desired to put any one or more of a number of wires speedily in connection or electrical continuity with any other or others thereof for telegraphic, telephonic, or other similar or equivalent purposes or uses—are, to simplify the construction and arrangement mechanically and electrically of the means by which this object can be obtained, and to greatly reduce the number of parts required, to avoid all complexity in the arrangement thereof, so that the operation of effecting the required connection may be expedited and more simply effected than as hitherto, and so that the operation of the apparatus may be rendered more reliable and accurate.

1029. "Incandescent electric lamps." F. Wright and M. W. W. Mackie. Dated March 3. 6d. Relates to the construction of the bulbs of electric lamps, and means of attaching the fibres to their conductors in a simple and durable manner. In forming the bulb with the conducting wires the inventors proceed as follows:—The inventors fix on a tube by means of spun glass the two conducting wires which have the carbon fibre attached to them. The tube with the wires on it is inserted into the tubular throat of the bulb, and then by heating the tubular throat it is caused to collapse on the tube and wires, closing them in hermetically. The end of the inner tube is drawn out to a small bore, and forms the passage for extracting air from the bulb. By heating the throat of the bulb, and pushing the inner tube in, the throat is caused to fold inwards on itself, so that the point of the inner tube is in such a position as to be protected by the external throat of the bulb projecting beyond it. For attaching the fibre to its conductors the inventors first thicken the ends of the fibre by coating them with syrup, and then carbonising the sugar of the syrup by application of sulphuric acid. The thickened ends of the fibre are inserted into tubular pieces of platinum, formed by bending the ends of platinum strips into tubular form, and the platinum is tightened on the fibre by a washer of steatite enclosing it.

1031. "Vacuum pumps for exhausting bulbs of electric lamps, &c." F. Wright and M. W. W. Mackie. Dated March 3. 6d. Relates to vacuum pumps for exhausting the bulbs of electric lamps or other vessels in which great rarefaction of air is required, the object being to provide in simple and compact form for utilising the barometric column of mercury as a seal for the outlet of





the discharged air. Fig. 1 shows an elevation of one arrangement of the apparatus. A is a tube having a number of branches, on which are temporarily secured in an air-tight manner the bulbs, or vessels, B, to be exhausted of air. The tube, A, after ascending a height of more than 30 inches, descends again, and enters the vacuum vessel, C, in which it descends some distance, as shown, and being closed at its lower end, has a small lateral opening or openings, A^1, formed in it, as shown more clearly in the enlarged view at fig. 2. The vessel, C, has a narrow neck, C^1, through which the tube, A, passes, and above which it is expanded into a cup, C^2. The tube, A, carries a caoutchouc washer, D, that closes the neck, C^1, as a valve, and the cup, C^2, above it is partly filled with mercury, acting as a seal. The vacuum vessel, C, has a tube, C^3, extending down more than 30 inches, and connected by a flexible tube, E, to the tube, F^1, of a vessel, F, filled with mercury, and supported so that it can be raised and lowered to a certain extent. The vessel, C, and tubes, C^3, E and F^1, being also filled with mercury, it will be seen that on raising the vessel, F, the mercury will also rise in C, thereby forcing the air in its upper part out through the valve, D. On again lowering the vessel, F, the mercury in sinking in C will cause air to be drawn from the bulbs, B, through the tube, A, and opening, A^1, into the vacuum thus formed in the upper part of C, and this air will be again expelled through the valve, D, on causing the mercury to rise in C by raising the vessel, F, again, the opening, A^1, being closed by the mercury, so as to prevent any escape of the air back into the tube, A. The above operation of causing the mercury alternately to descend and ascend in the vessel, C, being repeated, the air will be gradually exhausted from the bulbs, B, to any required degree. The cup, C^2, has an overflow branch, C^4, connected by a flexible tube, G, to the mercury vessel, F, so that any excess of mercury can flow back from C^2 into F.

1034. "Galvanic chains." C. D. Abel. (A communication from abroad by L. A. Kraehmer, of Dresden.) Dated March 3. 4d. According to the present invention galvanic chains are constructed as follows:—A zinc plate and a copper plate are secured on opposite sides of a piece of cloth or felt of corresponding shape, the metal plates having for this purpose a series of holes through which and through the cloth or felt are passed silk cords or threads so as to secure the three parts together, forming thus a link of the chain. The zinc plate has projecting at one end a loop, and the copper plate has projecting from the other end a hook, or *vice versâ*, and the several links being placed so that the copper plates alternate on each side with the zinc plates, the zinc plate of the one link is connected by its loop to the hook of the copper plate of the contiguous link on the one side, while the copper plate of the said link is connected to the zinc plate of the contiguous link on the other side, the connections thus forming hinge-like joints, enabling the chain to fit in any desired position. To the end links of the chain are by preference attached single zinc and copper plates, respectively serving as electrodes for making contact with the part of the body to which the chain is applied. The copper plates are by preference gilt to prevent oxidation. When in use the cloth or felt is impregnated with suitable liquid for maintaining an active galvanic current.

1036. "Manufacture of carbons for electrical purposes." H. Liepmann and P. S. Looker. Dated March 3. 6d. Refers to the manufacture of carbons from materials as hereafter described and their subsequent treatment so as to render them of a high density and suitable for the production of electrodes and other electric candles and filaments, whether they be rods, tubes, plates, lumps, discs, filaments, or otherwise suitable for electrical and other purposes. For the purposes of the invention the inventors employ the material known in commerce as the "corosso," or ivory nut, or vegetable ivory, or its clippings, turnings, or filings, or a material or materials of an analogous nature. The nut may be used without the shell or the two may be combined, or the shell may be used alone for filaments; the material is subjected to destructive distillation, or the material is carbonised in any other convenient manner either by heat or by the action of acids so as to leave the carbon produced therefrom in as pure or partially as pure a state as may be. The nuts or other materials as aforesaid may be used alone or in combination with other materials such as sugar, resins, oils, and essences or their equivalents, capable of producing a substantially pure product. When the "corosso," or ivory nut, or material before referred to has been subjected to destructive distillation a light and heavy liquid goes over; this distillate may be treated separately to get other products, or it can be utilised to mix with carbon obtained as described to form a pasty mass alone or with other materials.

1054. "Telephonic apparatus." N. K. Cherrill. Dated March 4. 4d. Relates to methods of producing and utilising what are called and known among electricians as "undulatory" currents of electricity, and to applying the same for the purpose of transmitting signals or sounds to a distant station by means of a "line-wire" or other electrical conductor, as is now commonly employed in electric or telephonic signals. The inventor forms a flat spiral of wire which may be single, double, three or more fold. The same may be attached to a diaphragm in such a manner that it will be free to vibrate by the action of sound, or it may be so constructed as to vibrate without a diaphragm, and he then so adjusts the said diaphragm and wire, that the said vibrations may be made across the lines of magnetic force of either a permanent or electro-magnet, and he uses the currents generated in the said spiral coils for transmitting the electrical impulses to a distant station for the purpose of there actuating signals by electric or magnetic induction, either by instruments already known and used, or by novel adaptations to be hereafter described, or by duplicates of the transmitting instruments. (*Provisional only.*)

1139. "Dynamo or magneto-electric machines." T. J. Handford. (A communication from abroad by T. A. Edison, of America.) Dated March 9. 6d. The object of this invention is such an improvement upon electrical generators and engines of the Pacinotti type, that the inactive portions of the bobbin will have a greater cross sectional area, and a lower resistance per unit of length than the active portions, so that the internal resistance of the machine will be reduced to the minimum. The object is accomplished by forming the bobbin coils of bars, which extend on the outside of the ring or annular core, parallel or nearly parallel with the axis of rotation, and of wide plates on the inside of the ring, the bars and plates being connected to produce a continuous bobbin by radial end bars.

CITY NOTES, REPORTS, MEETINGS, &c.

THE ANGLO-AUSTRIAN (BRUSH) ELECTRICAL COMPANY (LIMITED).

The first general meeting of shareholders of the above-named company was held at the company's offices, 4, Copthall Buildings, E.C., on Tuesday, Sir William Stephenson, K.C.B., in the chair. Mr. Wm. Thompson, secretary, having read the notice convening the meeting, the Chairman said: Gentlemen, the present meeting is convened in accordance with our statutes which require that the first general meeting of the company should be held within four months after registration. I need hardly remark that it would be inexpedient at the present stage to enter into details regarding a good deal that the board is doing for establishing the company's business, but there are several matters on which the shareholders would probably like to be informed, which I will take this opportunity of communicating to them, and I also wish to say a few words regarding the general policy the board is pursuing. In the first place, as regards the company's capital, I may inform you that 26,668 ordinary shares were subscribed by the public in response to the prospectus we issued. I have also to inform you that a modification was agreed to by the vendor in the arrangement with him, by which he accepted for the patents transferred by him, only £27,000, instead of £55,000, in cash on account of the total sum of £75,000 due to him. The balance of the purchase money he accepted in 5,600 shares fully paid up, and 8,000 shares credited with £2 10s. per share paid up. By this modification the company has a larger proportion of its subscribed capital available for developing the business than if the original mode of paying for the patents had been adhered to. With regard to the business of the company, you are aware that we possess the Brush and Lane-Fox patents for Austria and Hungary, together with certain advantages in connection with same in Roumania, where no patent laws at present exist. So far as concerns our articles of association, however, we are at liberty to carry on business in any other country. I think I need not dwell upon the merits and commercial value of the Brush system of electric lighting, which have been amply proved by the substantial results obtained in the United States and in England, but I may state that we have satisfied ourselves that a large field exists in Austria, Hungary, and Roumania for which this class of lighting is suitable, and I may add that Brush lights are already in use at the present time in several manufactories in Austria. But whilst we believe that the development of the Brush system in its proper field will prove a highly remunerative business in the countries referred to, we are satisfied that the development of a system of distribution of electrical energy for domestic lighting and other purposes will prove a business of vastly greater importance. It is not so long ago that it was considered a great feat to operate 15 or 20 lights from one dynamo machine, and it is only a very short time ago that an enormous stride was considered to have been made when some of the streets in the City were lighted up by means of Brush lamps operated by a machine in Lambeth, and the Opera House in Paris was lighted up by means of Brush lamps operated by a machine placed in the Exhibition Building in the Champs Elysées. But to-day, the talk is not of 30, nor 40, nor 50 lights, but of thousands of lights operated from central stations, and it is not light only that we look to obtain from these central stations, but we expect them to supply us with heat and power; we expect to get our dinners cooked, our hair brushed, and our boots cleaned by these central stations. In fact, it is now realised that it is possible to lay on electrical energy to houses in a town, like water or gas, with the main conductors always charged for consumers to draw on at any hour of the day or night. This is the problem we now have to face. Now, the possession of the Lane-Fox patents gives this company advantages in connection with this part of the business which I believe it would be difficult to over-estimate. I wish to dwell especially on this matter, both on account of its importance to the company, and because this part of Mr. Lane-Fox's invention is hardly known or appreciated, being applicable to a degree of advancement in electrical engineering which we are only now reaching. Although I do not profess to be a technical man, the matter has been made so clear to me, that I think I can undertake to explain it. Mr. Lane-Fox appears to have conceived from the outset the idea of a general system of distribution of electrical energy. Dynamos, accumulators, and lamps were then in their infancy, but he foresaw the degree of perfection to which they would probably be brought; and whilst others were applying themselves to the improvement of matters of comparative detail, he, taking a bird's eye view of the whole subject, applied himself to the study of how he could link together the various elements he saw growing into shape so as to constitute the comprehensive system of distribution of electrical energy which he had conceived would be necessary to make electricity a commercial possibility. The result of his labour was the particular part of his patent to which I now refer and which sets out a combination of dynamos, accumulators, and incandescent lamps or other apparatus, by means of which the main conductors in the system of distribution of a district can be kept charged with electrical energy at a constant pressure, which can be drawn upon at all times for use in suitable apparatus to produce light, heat, power, or other effects. Now, it is very important to understand what this patented combination really covers. We probably, most of us, have a general notion of the offices which would be performed by the dynamos, accumulators, conductors, and lamps in a general system of electrical distribution in a town. We have a general idea that the current is generated by the dynamos when put in motion by steam-engines or other motors, that the accumulators perform the duty of reservoirs into which the dynamos pump the electric force, and from which the lamps can draw the supply they require and when required. But it is perhaps not so generally understood, at any rate by the public, that the various patents one hears of for dynamos, accumulators and lamps only cover details of construction, and that the fundamental ideas on which they are based are practically public property. I mean to say that the production of an electric current by mechanical action is not a patent; that the process of storing electricity by utilising the chemical effect of the electric current on certain substances is not a patent, and that the production of light by heating to incandescence in vacuo a filament of carbon, or other substance, is not a patent. All this can be effected more or less efficiently and economically by means of apparatus which is not patented, as well as by a great variety of patented apparatus; but dynamos, accumulators, and incandescent lamps, whether patented or unpatented, cannot be used in combination as a system except under Mr. Lane-Fox's patent. The question then arises, Can a system of distribution be established without using dynamo, accumulators and lamps combined, in the manner patented by Mr. Lane-Fox? On this point I am advised that although it is possible to feed the lamps direct from the machines, as has been commonly done hitherto, without the intervention of accumulators, it would be found, in a general system of distribution, that the difficulty of regulating the current to meet a varying demand, the additional cost which would have to be incurred to put down plant and machinery capable of meeting the maximum demand at any time, added to many other disadvantages, would practically put such an arrangement out of the field. It would be like attempting to supply water to a town without the intervention of reservoirs or gas without the intervention of gasometers. It amounts to this, therefore, that Mr. Lane-Fox's patent practically covers the distribution of electrical energy on a large scale. I understand that in London alone, with its 4,000,000 inhabitants, at least 30 millions of pounds sterling are invested in the gas industry, and this will enable us to form some conception of the business which may be developed when electricity comes to be laid on like gas, from house to house, and I think therefore it will be admitted that I was correct in the remark I made just now that I believe it is difficult to over-estimate the value of a patent like Mr. Lane-Fox's, which places us in such a pre-eminently favourable position to introduce a general system of distribution of electrical energy. This question of the development which the application of electricity is likely to take consequent upon the establishment of systems of distribution brings me to another point, viz., the position this company should assume in relation to the business to be created. Austria, Hungary, and Roumania contain together a population of over 42 millions of souls. A large proportion of this population no doubt is not in a position for local reasons to avail themselves of our electrical energy, and possibly a further proportion may have the bad taste to prefer electrical energy supplied by others than ourselves. But assuming that one-tenth part only of the population comes to us for electricity, it is obvious that it would be far beyond the powers of our company or indeed of any single company to undertake the working and administration of the systems of electrical distribution which even the above-mentioned small fraction of the country would require. Moreover, there are many reasons why the working of the systems of electrical distribution should be in local hands. In the opinion of the board the position this company should take is that of pioneer, in the first instance, and afterwards contractors and manufacturers, for the establishment of the systems of distribution which we believe and expect will result from our pioneering. The programme of operations determined on by the board in pursuance of this policy is to set up manufacturing works in Vienna forthwith, and at the same time to lay down a system of electrical distribution on a sufficiently large scale to demonstrate the practical and commercial possibility of the scheme. When this first test system is in satisfactory operation and it is known that our works are in running order, that we possess a properly organised staff, and that generally we can be depended on both in point of skill and responsibility to contract for the establishment of systems of distribution and also for their maintenance and the repair of apparatus, we believe that the formation of local companies to own and work under our licences systems of distribution for different towns and districts will not be a matter of difficulty. Of the practical success of the installations the board feels confident, and of the commercial success they feel equally sanguine in countries where the price of gas varies from 5s. 4d. to 12s. 8d. per 1,000 cubic feet. Now you will probably wish to know something of what we have done so far towards the realization of our schemes. On this point, although, as I mentioned before, I am obliged in the interests of the company to speak with some degree of reticence, I think I can say enough to satisfy you that the board has not allowed the grass to grow under its feet during the short space of time that has elapsed since the company was launched. In the first place we have secured in Vienna temporary premises, in which we are commencing our manufacturing operations pending the completion of negotiations for the purchase of one or other of two buildings, either of which is in every respect suitable for our permanent requirements. We have ordered in England a large number of machine tools for our factory, and many of them are already on their way to Vienna. The nucleus of our staff in Vienna is formed and is now engaged in organising our works. A committee of the board, consisting of myself and two directors, has just returned from a tour in Austria, Hungary, and Roumania, where we have been engaged in making general arrangements for carrying on the company's business. An important contract is being negotiated for the lighting of one of the principal buildings in Vienna, to form part of our first system of distribution. Negotiations are also proceeding for the sale of licences for certain districts, and an agreement has been signed for the conditional sale of the licence for one important district. The board is, however, very strongly of opinion that the sale of licences should not be pushed until the company is in possession of a working organisation and manufactory capable of meeting the requirements of licencees. On the success of the subsidiary companies depends, in the opinion of the board, the real success of our company, and we think it would be shortsighted policy for the sake of immediate re-

turns to part with licences, at present, which must become of much greater value so soon as the satisfactory working of our first installation has established our name. The committee, therefore, rather directed its efforts in Austria to securing the co-operation of persons of influence under an arrangement by which a participation is to be secured to them in the benefits which we shall derive from the formation of local working companies, in consideration of their contributing to the expenses of the experimental installations, and affording us their support in our operations. I am happy to say that satisfactory progress is being made in the matter. In Roumania, the committee had the honour of several interviews with the King, who showed the greatest interest in the question of electric lighting. His Majesty has given us orders to light up experimentally his Winter Palace, and the grounds of his Summer Palace at Bucharest. He has also given us the order to put down the leads for a system of distribution in his palace of Sinaia in the Carpathians, and the estimates for the permanent lighting of this palace by electricity are under consideration. The staff for carrying out the above work is on the spot, and some of the apparatus for Bucharest has already arrived and is in course of erection. The whole of the remainder is on its way out. The initiative taken in this matter by their enlightened, liberal, and enterprising sovereign bids fair to secure to the Roumanian people the prestige of being the first nation in the world to adopt and reap the benefits of a comprehensive system of distribution of electrical energy. Before concluding, there is one more matter to which I wish to refer, although it is one on which it will probably be necessary to call you together again. We have now in hand, as you are aware, business in Austria, Hungary, and Roumania. The two former countries, although under the rule of a common sovereign, are essentially distinct and separate. All these countries are desirous that their enterprises should bear the stamp of their own nationality, and although they are all disposed to view with favour the introduction of a business from England, it is not a recommendation in the eyes of the two latter that the name of Austria should appear in the title of our company to the exclusion of their own. Furthermore the board is of opinion that the name "Brush" in the title of the company, besides being extremely difficult to translate into a foreign language in the sense in which it stands, is rather misleading having regard to the development which the Lane-Fox patents are likely to take in the hands of this company. Under these circumstances the board is of opinion that it would be advantageous to the company to alter its title so as to bear a less distinctive character in respect of nationality and system. We think that some such title as the "International Electrical Company, Limited," would be more suitable, the more so as we have business in view in another country concerning which I hope to be able to give you some account when we meet again to settle the question of the alteration of our name. I trust that what I have said will satisfy you that the board is giving its earnest attention to your business. I shall be happy to afford further information should anything I have said not be quite clear, but at the same time I beg you to remember, should you ask me any questions, that information on matters of detail is of far greater use to your competitors than to you.

No questions being asked, Mr. Trevor proposed a vote of thanks to the chairman and the directors, and the proceedings terminated.

Brazilian Submarine Telegraph. — The directors recommend a final dividend of 3s. per share, making, with previous distributions, a total dividend of 6 per cent. for the year ended the 30th June, 1882, and also a bonus of 2s. per share, both free of income-tax, which together will amount to £32,500, being a distribution in the aggregate of 7 per cent. for the past year. A balance remains of £51,295, of which amount £50,000 has been placed to the reserve fund, increasing that fund to £407,663, and £1,295 carried forward. The above dividend and bonus will be payable on the 28th instant.

Reuter's Telegram.—An interim dividend at the rate of 5 per cent. per annum has been declared for the half-year ended 30th June last, payable on the 14th instant.

Eastern Extension, Australasia, and China Telegraph.—The accounts for the half-year ended 30th June last show a net profit of £113,393, against £94,755 for the corresponding period of 1881. After providing for two quarterly interim dividends and a bonus of 1s. per share, making together 3 per cent. for the half-year, and charging against the half-year's revenue £30,000, the balance of cost of the Singapore-Batavian cable, there remains £23,468 to be carried forward.

West India and Panama Telegraph.—The accounts for the six months to 30th June last show a balance of £12,621 on revenue account. After placing £5,000 to reserve the directors have decided to carry forward the balance of £7,621. In consequence of the unusually heavy cost of repairs to cables during the past and current half-years, the directors are unable to recommend a dividend on account of the arrears of dividend on the preference shares.

The Submarine Cables Trust announce that the coupons due on the 15th inst. will be paid on and after that date by Messrs. Glyn, Mills, Currie & Co. They must be left three days for examination.

The Globe Telegraph and Trust Company announces the payment of an interim dividend for the quarter ending 18th October of 3s. on the preference shares and 2s. on the ordinary shares.

The Direct United States Cable Company (Limited) state that the interest due on the 15th inst. on their six per cent. debenture loan will be paid on and after the 16th inst. at the Consolidated Bank, Threadneedle Street, E.C., where coupons should be left for examination three clear days before applying for payment.

Application has been made to the Committee of the Stock Exchange for a settling day and quotation on behalf of the Anglo-Austrian Brush Electrical Company (Limited) shares.

Directors of Electric Light Companies.—Mr. J. Irving Courtenay and Lieutenant-Colonel F. G. Steuart have retired from the board of the Hammond Electric Light and Power Supply Company (Limited).

Direct United States Cable Company.—This company notifies that the interest due on the 15th inst. on their six per cent. debenture loan will be paid on and after the 16th inst. at the Consolidated Bank.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. Oct. 11.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	13¾-14¼	14.13¾,14.13¾, 14.14.14ac.
		Do. Do.	10	28 - 32	28¾.9 ac
30,000	5	Australasian Electric Light, Power & Storage Co.	3	1½- 2	
24,900	10	British Insulite Co., Limited, "A" Shares	5	4½- 5	
30,000	5	Brush Electric Light & Power Co. (Scotland)	2½	1½- 1¾	1¾ ac.
25,000	5	Great Western Electric Light & Power Co.	2½	1 - 1¼	1¼.⅜ ac.
24,980	5	Hammond Electric Light & Power Supply Co.	2½	7½- 8	7¾.⅜.⅜.⅜.⅜ac
40,000	5	Indian & Oriental Electrical Storage Works Co.	2	1 - 1¼	1¼.1 ac.
172,500	1	Maxim-Weston Electric Light and Power Co.	1	⅝- ¾	¾ ac.
40,000	5	Pilsen-Joel & General Electric Light Co.	2	1¾- 2¼	
		South African Brush Electric Light & Power Co.	2½	.. ..	
100,000	5	Swan United Electric Light Co., Limited	2	2 - 2¼	2¼.⅜ ac.
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	50 - 51	50¾.1 ac.
2,441,800*l.*	Stk.	Do. Preferred Def'd. receiving no div. until	100	82½- 83½	83.¼ ac.
2,441,800*l.*	Stk.	Do. Deferred 6 p. c. has been paid to Pref.	100	19½- 20½	20¼ ac.
130,000	10	Brazilian Submarine, Limited	10	11⅝-12½	12¼.¼m. 12½. ⅛ ac.
16,000	10	Cuba, Limited	10	9¼- 10¼	
6,000	10	Do. 10 per cent. Preference	10	16 - 17	
13,000	10	Direct Spanish, Limited	9	6½- 6¾	
6,000	10	Do. 10 per cent. Preference	10	15½- 16½	16 m.
65,000	20	Direct United States Cable, Limited, 1877	20	12 - 12½	12⅛.⅛.⅛ ac.
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	101 -104	
380,000	10	Eastern, Limited	10	10¾- 11	10⅞ ac.
70,000	10	Do. 6 per cent. Preference	10	12¾- 13¼	
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	102 -105	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	101 -104	
199,750	19	Eastern Extension, Australasia & China, Limited	10	11¼- 11¾	11⅝ ac.
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	103	107 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	102 -105	
140,000	100	Do. do. registered, repayable 1900	100	102 -105	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 -105	
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan 1900	100	101 -104	
345,700*l.*	100	Do. do. do. To Bearer	100	101 -104	
22,050	10	German Union Telegraph and Trust, Limited	10	9¼- 10¼	
163,390	10	Globe Telegraph and Trust, Limited	10	6¼- 6¾	6¾ ac.
163,209	10	Do. 6 per cent. Preference	10	12½- 12¾	12¾ ac.
125,000	10	Great Northern	10	12½- 12¾	
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	26½- 27½	
100,000	100	Do. 6 per cent. Debentures, 1886	100	100 -103	
17,000	25	Indo-European, Limited	25	30½- 31½	
38,148	10	London Platino-Brazilian, Limited	10	4¼- 5	
12,060	10	Mediterranean Extension, Limited	10	1¾- 2¼	
8,200	10	Do. 8 per cent. Preference	10	8 - 9	
9,000	8	Reuter's, Limited	8	12¾- 13¼	
280,000	Stk.	Submarine	100	250 -260	
58,225	1	Do. Scrip	1	2¾- 2¾	
4,200	Cert.	Submarine Cables Trust	100	103 -108	
37,350	12	Telegraph Construction and Maintenance	12	30½- 31¾	30¾.1¼ ac.
150,000	100	Do. 6 per cent. Bonds, 1884	100	101 -104	103¼ m.
186,750	5	Do. 2nd Bonus Trust Cert.	5	1¼- 1¾	
30,000	10	West Coast of America, Limited	10	4¼- 4¾	
150,000	100	Do. 8 per cent. Debentures	..	.. ..	
69,910	20	Western and Brazilian, Limited	20	6¾- 7¼	7 ac.
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	104 -107	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	97 -100	
1,500	$1,000	Western Union of U. S. 7 p.c. 1 Mort. (Building) Bds.	$1,000	123 -128	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	100 -103	
88,321	10	West India and Panama, Limited	10	1¾- 1⅞	
34,563	10	Do. 6 per cent. 1st Preference	10	7¼- 8	
4,669	10	Do. 6 do. 2nd do.	10	6½- 7	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1 - 1¼	1⅛ ac.
200,000	1	Oriental Telephone Co., Nos. 100,000 to 300,000	¼	⅛- 1	
100,000	5	United Telephone Co.	5	10½- 11	

TRAFFIC RECEIPTS.

The Cuba Submarine Telegraph Company (Limited). The number of messages passing over the lines of this company during the month of September was 2,484, estimated to produce £2,250, against 2,024 messages, producing £2,030, in the corresponding month of last year. The June receipts, estimated at £2,900, realised £2,951.

The Direct Spanish Telegraph Company (Limited). The estimated traffic receipts for the month of September, 1882, are £1,812, as against £1,790 in the corresponding period of last year.

The Eastern Telegraph Company. The traffic receipts for the month of September, 1882, were £57,271, against £47,407 in the corresponding period of 1881

The Eastern Extension Telegraph Company. The traffic receipts for the month of September, 1882, were £32,955, against £30,866 in the corresponding period of 1881.

The Great Northern Telegraph Company. The traffic receipts in September, 1882, were £21,280 from the 1st January to 30th September, 1882, £181.840, in the corresponding months of 1881, £180.279. and in the corresponding months of 1880, £176.64£.

The West Coast of America Telegraph Company (Limited). The traffic receipts for the month of August, 1882, were £3,400, against £3,185 in the corresponding period of 1881.

The Western and Brazilian Telegraph Company (Limited). The traffic receipts for the week ending 20th September, 1882, were £2,360; and for the week ending 6th. October, 1882, were £2,626, both after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Telegraph Company (Limited).